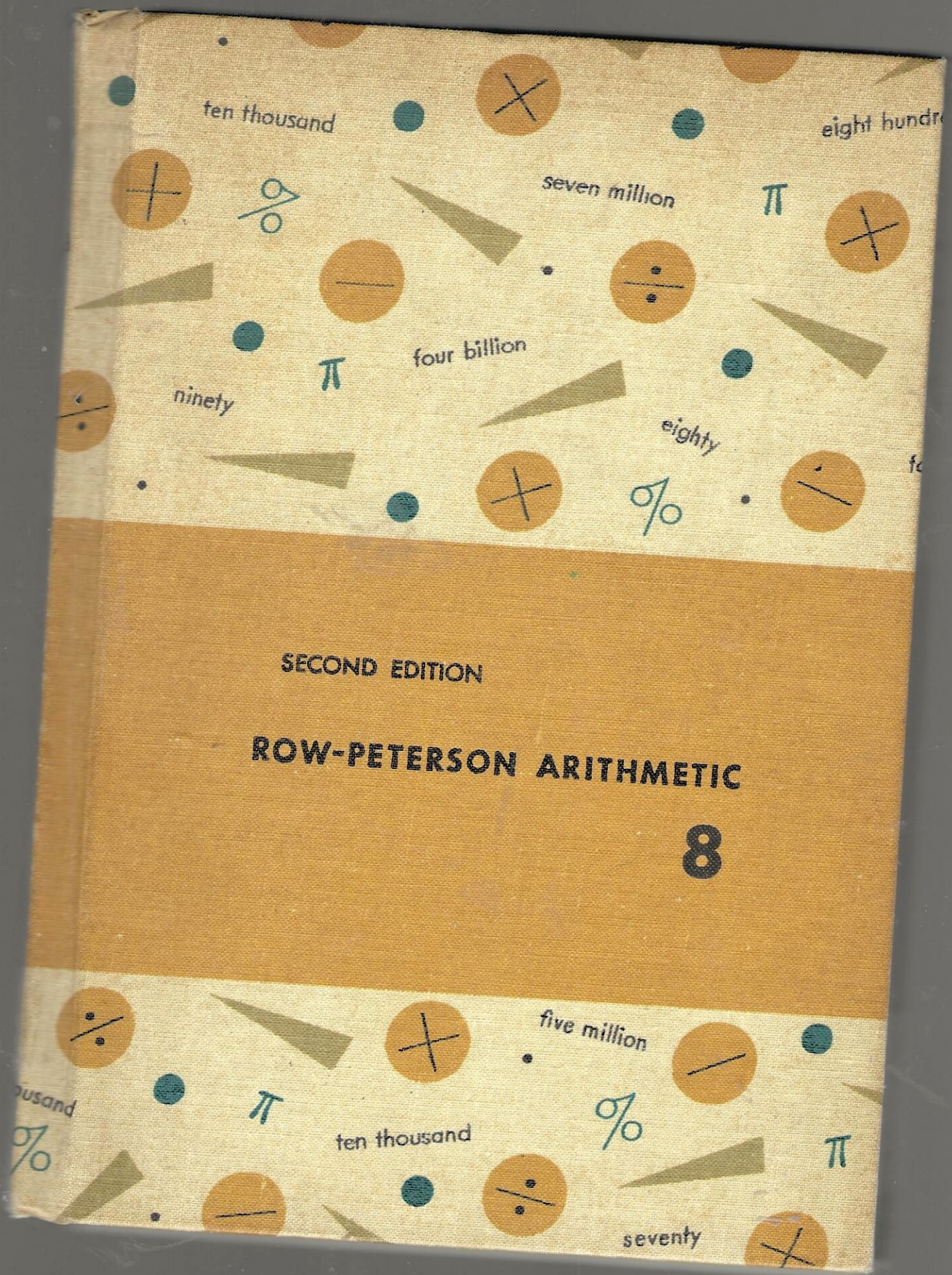

SECOND EDITION

ROW-PETERSON ARITHMETIC

8

SECOND EDITION

ROW-PETERSON ARITHMETIC

BOOK EIGHT

By

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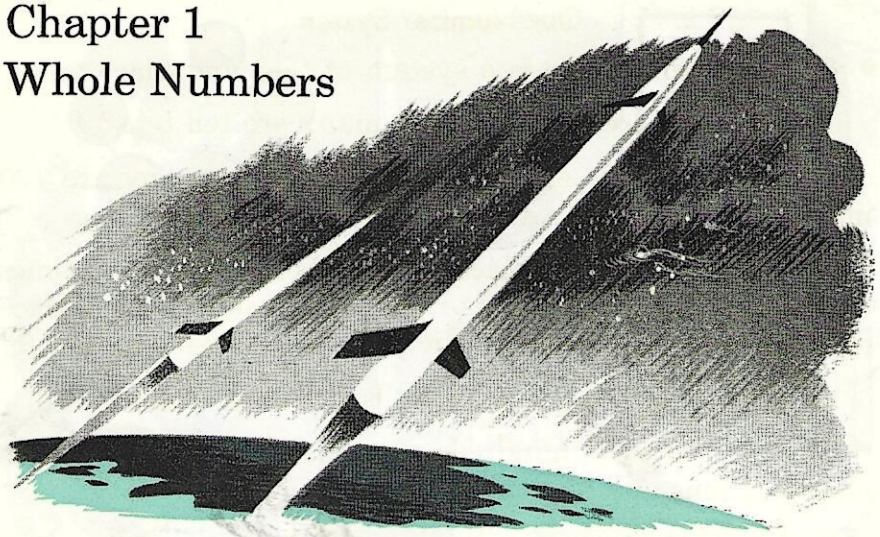
ROW, PETERSON AND COMPANY

Evanston, Illinois Elmsford, New York

Chapter 1
Whole Numbers



Hot-Speed Age

During World War II aircraft designers were devising ways to keep ice off the wings of planes. Today they are searching for ways to keep the wings of planes and noses of missiles from melting or burning up.

Because of new steel, aircraft and missiles can fly through air-friction heat of 1000° at speeds of **Mach** 4 (2720 miles per hour) or 4 times the speed of sound.

1. What is the speed of sound?

2. What does Mach 2 mean? Mach 3?

3. The speed of a bullet is about 1360 miles per hour. How many times the speed of sound is this?

4. The X-2 rocket hit a speed of 2260 miles per hour. Was its speed more than Mach 3 and less than Mach 4? How does it compare with the speed of a bullet?

Above 35,000 feet where high flying is done, the air temperature is 60° below zero. At Mach 1 the "skin" temperature rises to 100°; at Mach 2 to 250°; at Mach 3 to 600°; and at Mach 4 to 1000°.

5. Is 35,000 feet about 7 miles?

Our Number System

• Our number system is a system of tens and place value.

1. Ten ones are one ten. How many are ten tens?

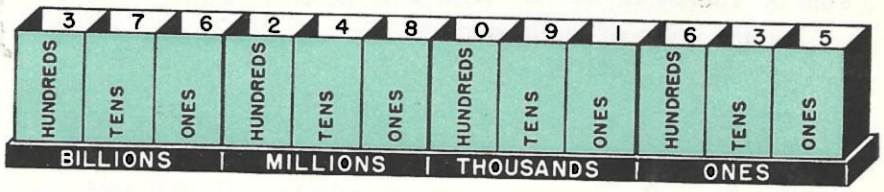
2. Ten hundreds are one thousand. How many are 100 hundreds? How many are 1000 thousands?

3. The value of each place of a number is how many times the value of the place to its right? The value of each place of a number is what part of the value of the place to its left?

4. Each figure of a number tells what two things?

5. 635 means ▨ hundreds, ▨ tens, and ▨ ones; or it means ▨ tens and ▨ ones.

6. For convenience in reading and recognizing numbers we mark them off into groups of three, beginning at the right. Read the number: 376,248,091,635.


3 7 6 2 4 8 0 9 1 6 3 5
HUNDREDS TENS ONES HUNDREDS TENS ONES HUNDREDS TENS ONES HUNDREDS TENS ONES
BILLIONS | MILLIONS | THOUSANDS | ONES

• In our number system we use ten figures: nine numerals show quantity; zero is written in any place that has no quantity. It holds the empty place.

7. Without 0 we could not use our system. Why?

8. Write these numbers: (*a*) six thousand, one hundred fifty; (*b*) one million, seven hundred ninety thousand; (*c*) thirty-five hundred nine.

9. What does 7 mean in each of these numbers?

573 1703 762,980 4,370,620 2,549,807

10. In which of the numbers above are there 70 tens? 7 tens? 62 thousands? 62 tens? 98 tens? 98 hundreds?

11. Write a five-place number that has no numeral in thousand's place. Why did you write 0 in that place?

Roman Numbers

• The Romans used seven letters to write their numbers. Each letter has a certain value. There is no place value and no zero in their system.

I = one V = five X = ten L = fifty
C = one hundred D = five hundred M = one thousand

• To write numbers these rules are followed:

Rule 1. *Repeating a letter repeats the value.*

II = two XXX = thirty XXIII = twenty-three

Rule 2. *A letter to the right of a letter of greater value increases the value of the larger one.*

VI = five and one, or six XV = ten and five, or fifteen
LX = fifty and ten, or sixty
LXV = fifty and ten and five, or sixty-five

Rule 3. *A letter to the left of a letter of greater value decreases the value of the larger one.*

IX = one less than ten, or nine
XL = ten less than fifty, or forty
CD = one hundred less than five hundred, or ▨

Notice how these numbers are written using figures and the Roman numerals:

75 = LXXV 450 = CDL 1950 = MCML

1. Read these numbers: XIX LVII CCXI CXLV CLXV CCIX DL MCDXCII MCMXXIX

2. Write these numbers using the Roman numerals:

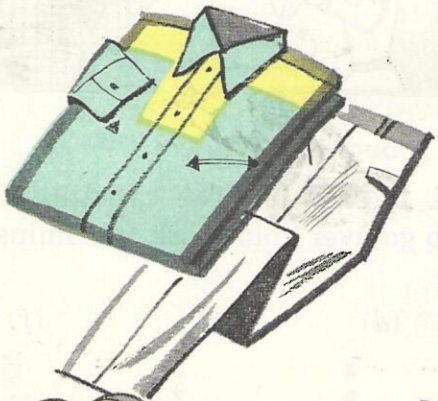
43 782 150 1128 1621 1960

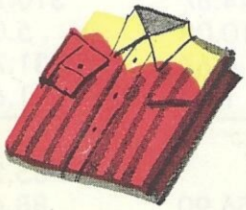
3. The Romans had to carry a counting board to the store to figure their bills. Why?

4. What 2 ideas make a counting board unnecessary now?

RIDING APPAREL

Men's and Women's Pants...	$8.75
Ladies' Suede Jackets.....	$19.95
Ladies' Corduroy Jackets....	$10.95
Ladies' Western Shirts.....	$6.95
Boys' and Girls' Shirts.....	$3.95
Boys' and Girls' Pants.....	$4.95
Children's Western Boots....	$7.95
Ladies' Boots.....	$16.50
Men's English Boots.....	$21.50





Buying at the Store

1. Mrs. Wills bought a corduroy jacket, a pair of riding pants, a pair of boots, and a shirt. What was her bill?

2. Mr. Wills bought a pair of boots and a pair of pants for himself. How much did he spend for them?

3. Mr. Wills also bought an outfit for Bill and one for Jane. Each outfit contained 1 pair of pants, 1 shirt, and 1 pair of boots. How much did the two outfits cost?

4. Mr. Wills paid for all the purchases. How much was his total bill at the store?

TYPIST'S ERROR CUTS $200,000 OFF CONTRACT

A $200,000 error in a contract bid probably will have to be settled in court.

This became apparent when officials of the Ajax Electric Company reported that the school board had accepted their bid on a school job which read $364,864 but should have read $564,864.

Careful and Thoughtful Work

Errors may be expensive. It pays to work carefully and thoughtfully. It also pays to go over your work to eliminate errors.

	(a)	(b)	(c)	(d)	(e)	(f)
1.				4	3	5
	5	9	9	8	7	6
	7	6	6	8	5	7
	9	4	6	3	5	6
	5	1	7	8	3	9
	8	5	9	6	9	5
	5	7	7	9	7	6
2.	30	850	506	$8.25	$44.87	$10.23
	24	912	230	4.16	10.08	5.00
	41	723	411	9.04	6.67	31.72
	73	642	852	.45	1.14	1.63
3.						$ 785.25
				1456	$56.90	88.67
	68	96	897	5234	15.86	944.00
	74	24	459	1800	20.74	1503.42
	92	88	415	790	66.75	41.59
	13	67	206	7263	81.97	4860.75

Subtraction

When we carry in adding, we change 10 ones to 1 ten, or 10 tens to 1 hundred, or 10 hundreds to 1 thousand, and so on. In subtracting we do the opposite. We change 1 of the tens in the minuend to 10 ones or 1 of the hundreds to 10 tens, and so on.

1. How do we subtract in each example below?

borrow	borrow	carrying	borrow
Tens Ones	Hundreds Tens Ones	Thousands Hundreds Tens Ones	Hundreds Tens Ones
7 16	8 11	5 12 14	69 10
8 6	9 1 4	6 3 4 9	7 0 0
2 7	5 8 2	1 6 7 3	3 9 7
5 9	3 3 2	4 6 7 6	3 0 3

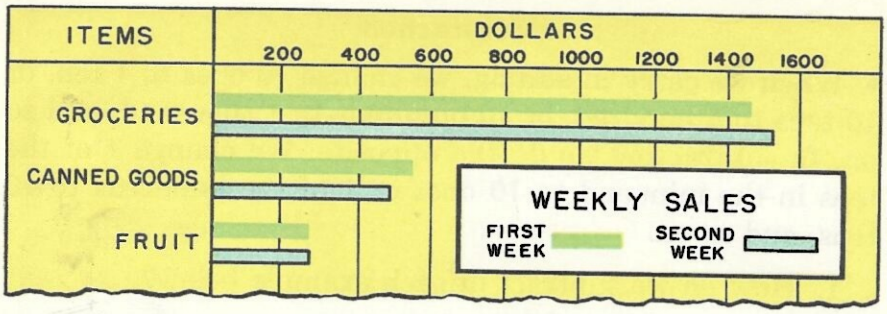
2. Jim earned $18.75 during one month. He bought new bicycle tires for $7.98. How much of his money was left?

3. The Arnold family started on a trip to a town about 700 miles away. They traveled 389 miles the first day. About how many miles did they still have to go?

4. Mrs. Olsen made 250 doughnuts. She sold 18 dozen and kept the rest for her family. How many doughnuts did she keep?

Subtract and check. How do we check subtraction?

	(a)	(b)	(c)	(d)	(e)	(f)
5.	692 540	784 685	626 259	560 97	300 128	2100 905
6.	705 489	204 57	$9.61 1.38	$5.00 3.64	$8.15 5.06	$8.05 6.90
7.	$11.25 8.88	$6.10 4.75	$1.50 .92	$10.25 7.67	$90.20 55.24	$115.00 30.63



Comparing Weekly Sales

Mr. Weldon has a small grocery store in the neighborhood. At the end of each week he compares the total sales with those of the previous week. Below are the total sales during the first and second weeks in September:

Items	First Week	Second Week	Increase	Decrease
Groceries	$1465.37	$1530.87		
Canned goods	546.29	492.06		
Fruits	268.27	271.65		
Vegetables	562.30	583.42		
Meats	829.41	780.93		
Other items	649.72	593.04		
Totals				

1. What is the total of Mr. Weldon's sales during the first week in September?

2. What is the total during the second week?

3. Did Mr. Weldon's total sales increase or decrease from the first week to the second week? How much?

4. Find the increase or decrease on each item.

5. Find the total increases and total decreases and compare them. Which is larger? By what amount?

6. Compare your answers for problems 3 and 5.

7. What facts does the graph show?

Multiplication

1. Explain these statements:

a We multiply by tens and hundreds the way we multiply by ones. When we multiply by tens, we start writing our product in ten's place. When we multiply by hundreds, we start writing our product in hundred's place.

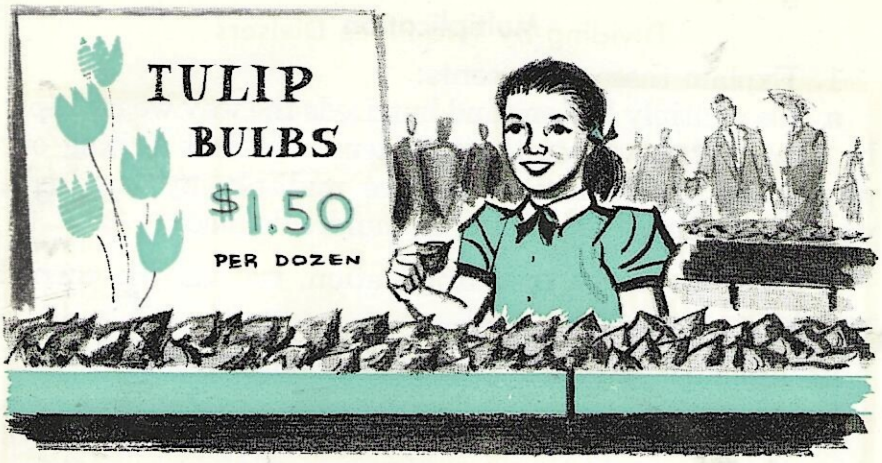
b When we carry in multiplication, we add the carried number to the next product.

2. Tell how we multiply in each example below:

268	268	268	268	376
4	40	47	247	204
1072	10,720	1 876	1 876	1 504
		10 72	10 72	75 20
		12,596	53 6	76,704
			66,196	

Multiply and check. How do we check?

	(a)	(b)	(c)	(d)	(e)
3.	47 × 5	83 × 7	79 × 4	65 × 8	6382 × 6
4.	97 × 87	29 × 36	88 × 60	90 × 46	540 × 83
5.	838 × 36	377 × 94	681 × 72	3654 × 71	1324 × 47
6.	248 × 219	431 × 309	463 × 176	879 × 689	3527 × 406
7.	\$10.30 × 85	\$9.29 × 30	\$7.08 × 56	\$12.66 × 78	\$4.90 × 19
8.	\$8.07 × 146	\$6.66 × 413	\$9.06 × 465	\$25.80 × 400	\$132.75 × 709



The Tulip Sale

The East Side Girls' Club sold tulip bulbs to make money to carry on their club work. They bought 1000 bulbs for $25.

1. The girls sold 12 dozen bulbs at $1.50 a dozen. How much did they get for them?

2. After the 12 dozen bulbs were sold, how many of the 1000 bulbs were left?

3. Ann and Sue took one fourth of the bulbs that were left and put them into bags, 2 bulbs to each bag. How many bags of bulbs did they have? The girls sold these bags of bulbs at 15¢ a bag. How much money did they get for these bulbs?

4. The city park board bought 500 of the bulbs. They paid $6.50 for each hundred bulbs. How much did the park board pay the girls?

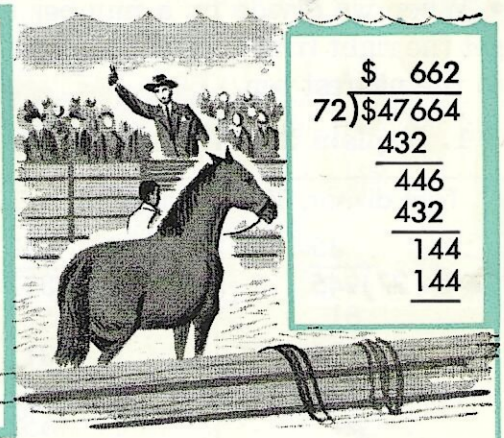
5. The girls sold 6 dozen bulbs at $.75 a dozen. How much did they get for them?

6. There were then 70 bulbs left. Jane and Betty put these bulbs in bags, 5 bulbs to the bag, and sold them for 35¢ a bag. How much did these bulbs bring?

7. Every bulb was sold. Find how much the girls made on the bulb sale.

QUARTER HORSE AUCTION SPURS LIVELY BIDDING

72 Bring Total Offers to $47,664



$$\begin{array}{r} \$\ 662 \\ 72\overline{)\$47664} \\ 432 \\ \hline 446 \\ 432 \\ \hline 144 \\ 144 \\ \hline \end{array}$$

1. The bids ranged from $100 for a colt to $2900 for a fine cutting horse. Seventy-two horses brought a total of $47,664 or an average of $▨ each.

• We divide by tens the way we divide by ones. We write each part of our answer in its proper place.

	(*a*)	(*b*)	(*c*)	(*d*)
2.	$35\overline{)1785}$	$54\overline{)883}$	$63\overline{)850}$	$34\overline{)725}$
3.	$56\overline{)1176}$	$43\overline{)3196}$	$85\overline{)4378}$	$71\overline{)5822}$
4.	$53\overline{)11885}$	$81\overline{)70937}$	$24\overline{)98950}$	$53\overline{)32870}$
5.	$28\overline{)\$56.56}$	$12\overline{)\$49.68}$	$51\overline{)\$247.86}$	$78\overline{)\$237.90}$

6. The Saturday Club had a picnic. Food supplies cost $18.27; the bus cost $24.50. The 21 members divided the expenses equally. What was each member's share?

7. Mrs. Bender paid $3.75 for a bushel of cherries to can. She used $1.15 worth of sugar and about 36¢ for gas. If she canned 25 quarts, about how much did each quart cost?

Rounding Off Numbers in Dividing

• When we divide by a number that ends in 7, 8, or 9, we get the right trial quotient more often if we round the divisor to the nearest ten.

1. Explain the divisions below.

Trial divisor, 30	Trial divisor, 70	Trial divisor, 20
35 27)945 81 135 135	548 69)37812 345 331 276 552 552	69 18)1242 108 162 162

2. Round these numbers to nearest ten:

67 83 95 78 54 89 46 37

Divide. Round the divisor to get the best trial divisor.

	(a)	(b)	(c)	(d)
3.	27)675	35)665	36)17892	49)3283
4.	79)6696	37)1702	58)42688	76)28424
5.	48)32387	67)3216	39)22971	56)5488
6.	23)11684	29)17632	26)20982	36)14616

7. Round these numbers to nearest hundred:

243 592 678 360 514 889 299

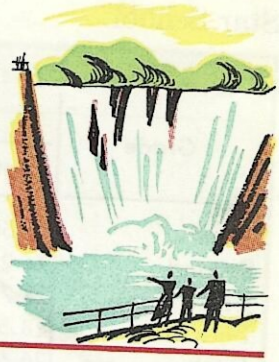
Divide. Round the divisor to get the best trial divisor.

	(a)	(b)	(c)
8.	276)12420	673)52494	384)18048
9.	481)301587	476)17136	198)11682

Cost Per Day

1. How much will each trip cost per day on the average?

Trip A



Eastern Vacations

NIAGARA FALLS-CANADA—Streamliner to Detroit, Lake Erie cruise Detroit to Buffalo-Toronto. Whirlpool Rapids. Cave of the Winds. Bridal Veil Falls. 5 days. Weekly. May-October..... **$117.50**

Trip B

Colorado Vacations

COOL COLORADO—Five Tours—The most outstanding choice of tours including Denver, Rocky Mountain Park, Estes Park, Colorado Springs, Pikes Peak and the famed Cliff House, Manitou Springs, Colorado. 8 days. Weekly. May-October..... **$138.40**

Trip C

Southern Vacations

FLORIDA CIRCLE—Gala 9 day circle tour. Entire West and East Coasts of Florida—St. Augustine. Orlando. Silver Springs. Tampa. St. Petersburg. Bok Singing Tower. Lake Wales. 4 days at Ocean front hotel in Miami Beach. Year round. Weekly..... **$166.05**
16-Day Tour Including Havana, Cuba..... **$310.40**

Trip D

Mexico Vacations

MEXICO—Both Modern and Medieval Mexico. 18 days of relaxation, comfort, and unbelievable vacation pleasure. 15 nights in Mexico's finest hotels. Travel Pan American Highway. See Zimapan, The Pyramids, Taxco, Cuernavaca, Cholula, Xochimilco, Valles, Puebla, Monterrey, Mexico City and Acapulco. 18 days. Departs Saturdays..... **$389.70**

Finding Averages

The table below shows the amount of money invested in Savings Stamps each month by pupils in each grade of the Star School:

Grade	AMOUNT OF MONEY BY MONTHS								
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
First	22.50	32.10	40.00	20.20	60.40	52.80	48.60	52.70	40.90
Second	24.25	30.25	36.25	25.70	55.50	50.25	46.40	48.30	50.10
Third	23.75	28.75	32.80	20.60	35.60	35.85	40.75	42.75	36.20
Fourth	28.50	30.50	35.50	30.20	40.10	32.50	36.00	36.70	32.75
Fifth	26.60	30.00	36.75	24.40	42.90	36.20	32.25	40.20	42.80
Sixth	24.90	27.80	32.70	25.75	52.00	36.10	38.50	38.25	32.25
Seventh	18.75	20.75	30.45	24.50	40.75	25.75	31.85	34.60	30.60
Eighth	12.50	12.90	15.50	8.75	20.25	20.25	14.75	15.90	11.90
Average									

To find the average amount per grade invested in Savings Stamps during September, (1) we find the total, and (2) we divide by the number of grades. Since the amounts are dollars and cents, we find the average in nearest whole cent.

$$
\begin{array}{r}
\$22.72 \\
8\overline{)\$181.75} \\
16 \\
\hline
21 \\
16 \\
\hline
57 \\
56 \\
\hline
\text{sensible}\begin{cases} 15 \\ 16 \end{cases}
\end{array}
$$

1. Find the average amount invested per grade for each of the remaining eight months in nearest whole cent.

2. Find the average amount invested per month by each grade in nearest whole cent.

3. Divide. Find the answers in nearest wholes.

(a)	(b)	(c)	(d)	(e)
$6\overline{)843}$	$8\overline{)7685}$	$24\overline{)7642}$	$63\overline{)8763}$	$31\overline{)7530}$

The Cost of Owning an Automobile

Six years ago when Mr. Watson bought a used car, he decided to keep a record of everything he had to pay to keep it in good condition. This is what his record showed:

Items	Amounts
Paid for car	$1487.75
Present value of car	275.00
Cost of car to date	$1212.75
Certificate of ownership from state	1.00
3595 gal. gasoline at 31¢ (average)	_____
318 qt. oil at 45¢	_____
Car washed 26 times at $1.50	_____
Car greased 52 times at $1.75	_____
6 years' fire and theft insurance at $14.50 a year	_____
6 years' accident insurance at $26.67 a year	_____
6 years' license tags at $18.80 a year	_____
6 years' garage rent at $5.50 a month	_____
92 nights' storage on trips at 75¢ a night	_____
10 punctures mended at 75¢ each	_____
6 new tires and tubes at $18.65	_____
4 tires retreaded at $9.60	_____
Overhauling and repairing	278.26
Total cost for 6 years	$_____

1. How much did Mr. Watson's car cost each year on the average?

2. How much was the average cost for each month?

3. Counting 30 days as 1 month, how much was the average cost each day?

4. During the 6 years, Mr. Watson drove his car a total of 53,864 miles. What was the average distance each year?

5. Find the average cost for each mile the car was driven.

6. About how many miles did Mr. Watson get from each gallon of gasoline?

Without Pencil and Paper

• When we find answers without the use of pencil and paper, we say that we do mental arithmetic or we do the work in our heads.

$37 + 46 = \square$
$37 + 40 = 77$
$77 + 6 = 83$

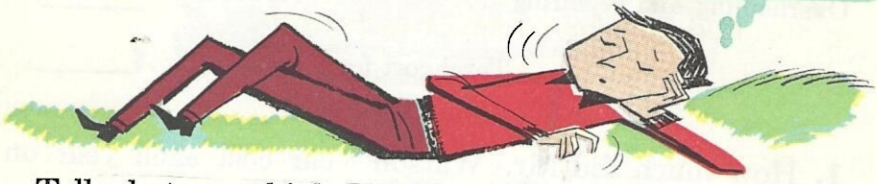
$37 + 46 = \square$
$40 + 46 = 86$
$86 - 3 = 83$

$58 + 67 + 78 = \square$
$5 + 6 + 7 = 18$, which is really 180.
$8 + 7 + 8 = 23$
$180 + 23 = 203$

$125 - 87 = \square$
$125 - 85 = 40$
$40 - 2 = 38$

$132 - 65 = \square$
$132 - 60 = 72$
$72 - 5 = 67$

$500 - 246 = \square$
$500 - 250 = 250$
$250 + 4 = 254$



Tell what you think in doing these additions?

	(a)	(b)	(c)
1.	$38 + 57$	$44 + 87$	$62 + 57 + 64$
2.	$87 + 29$	$76 + 24$	$36 + 78 + 29$
3.	$197 + 45$	$276 + 48$	$81 + 98 + 57$

Tell what you think in doing these subtractions:

4.	$91 - 18$	$82 - 77$	$122 - 74$
5.	$141 - 98$	$183 - 96$	$600 - 208$
6.	$437 - 139$	$200 - 137$	$900 - 435$

$34 \times 18 = \square$
$30 \times 18 = 540$
$4 \times 18 = 72$
$540 + 72 = 612$

$18 \times 34 = \square$
$20 \times 34 = 680$
$2 \times 34 = 68$
$680 - 68 = 612$

$6 \times 196 = \square$
$6 \times 200 = 1200$
$6 \times 4 = 24$
$1200 - 24 = 1176$

Tell what you think in doing these multiplications:

	(a)	(b)	(c)	(d)
7.	14×12	15×31	91×21	46×15
8.	24×51	4×126	9×61	3×255

★ Often a person must work an arithmetic problem without using pencil and paper. For example, Bill's father bought 5 gallons of gasoline at 31¢ a gallon and a quart of oil for 45¢. He thought: $5 \times 31¢ = \$1.55$ and 45¢ is $2.00.

9. Jane bought 5 items in the grocery store for 10¢, 15¢, 25¢, 40¢, and 30¢. How much was her bill?

10. A baseball glove was priced at $13.85. Dusty has saved $11.54. How much more money does he need before he can buy the glove?

11. The weights of three boys were 140 pounds, 150 pounds, and 130 pounds. What was their average weight?

12. Julie bought 3 pounds of hamburger at 40¢ a pound, a pound of steak at 87¢ a pound, and a pound of wieners at 55¢ a pound. What was her meat bill?

13. If a track star runs a mile in 4 minutes, what is his average speed in miles per hour?

14. Henry won a pig at the fair. The pig weighed 65 pounds when Henry got him and 178 pounds one year later. How many pounds did the pig gain in a year?

Estimating Answers

It is a good habit to estimate answers before making the computations. It forms a rough check and often prevents foolish answers. One of the best ways of estimating is to round the numbers.

1. Tell how you would estimate the sum of 360, 492, and 1035. Is the sum about 1900?

2. How would you estimate the difference between 5630 and 1927? Is the difference about 3600?

3. How would you estimate the product of 67×1593?

4. What round numbers would you use to estimate the quotient of 83792 divided by 85? Is the quotient less than 1000?

Estimate each answer. Then compute and compare your exact answer with your estimate.

	(a)	(b)	(c)	(d)	(e)
5.	473 128 906 850	1054 638 95 409	8672 1923 869 5103 9927	1300 5603 8290 1527 6923	9637 1000 7309 8635 1928
6.	8302 −4591	7600 −1993	93060 −35786	50000 −45090	67429 −25906
7.	6349 ×29	8193 ×298	47268 ×907	39504 ×1603	51009 ×38

	(a)	(b)	(c)	(d)
8.	$17\overline{)357}$	$16\overline{)3280}$	$132\overline{)634260}$	$548\overline{)513600}$
9.	$605\overline{)258403}$	$392\overline{)222267}$	$287\overline{)136612}$	$905\overline{)489701}$

Progress Test

Do You Know?

1. Why is our number system called a system of tens?

2. What 2 things does each figure in a number tell?

3. What does our number system have that the Roman system does not have?

4. Write these numbers with figures:
- **a** twenty-seven thousand
- **b** one thousand six hundred nine
- **c** three hundred fifty thousand sixty-four
- **d** one million, one thousand one hundred one

5. What does the 4 mean in each number?
a 4065 **b** 2641 **c** 534 **d** 12400

6. In which numbers are 8 tens? 80 tens?
a 1785 **b** 3804 **c** 8227 **d** 1538

7. How many envelopes are in the box?

8. In what year was the school built?

9. In the number 8252 the 2 left of 5 represents a quantity ▨ times as large as the 2 right of 5.

10. In 842 the 8 has a value that is (*a*) twice the value of the 4; (*b*) 4 times the value of the 4; (*c*) 20 times the value of the 4; (*d*) 40 times the value of the 2; (*e*) 400 times the value of the 2.

11. If zero is placed after the 3 in 63, the new number is exactly ▨ times the original number. What happens if the zero is placed between the 6 and 3?

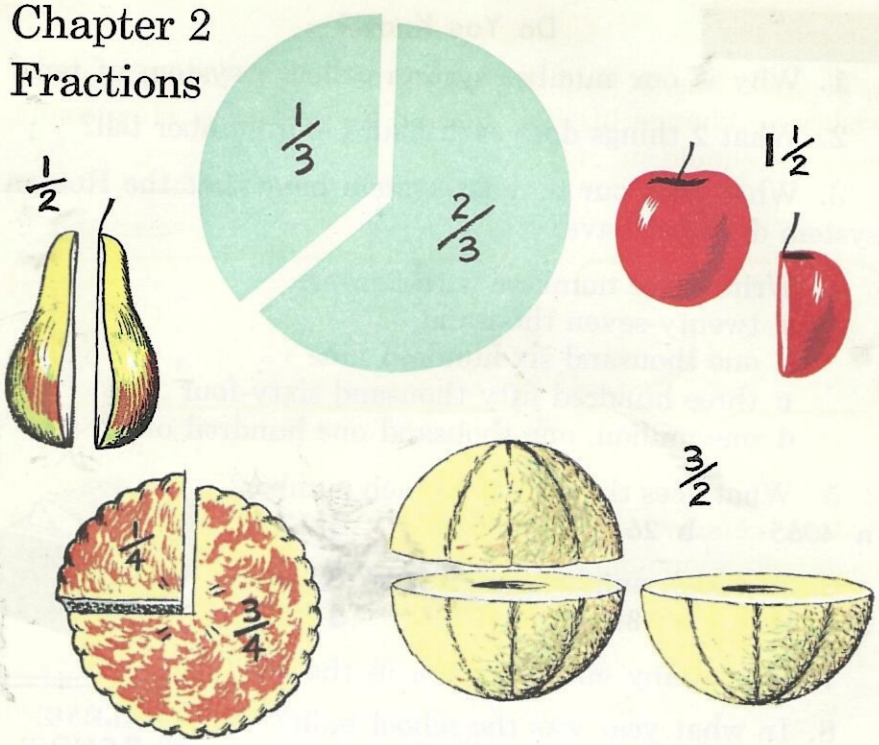
12. How much is carried (0, 1, 10, or 100) when we add 486 and 363?

13. 3724 + 805 + 1900 + 2692 + 865 + 39423

14. 5000 − 1969 509 × 1608 5505 ÷ 15

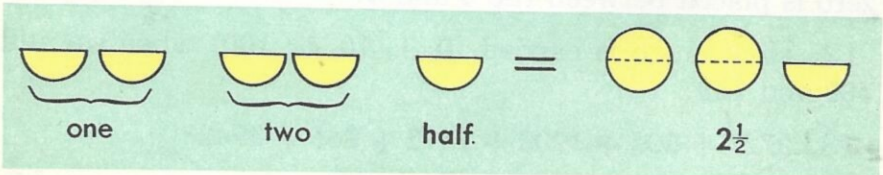
15. 47500 ÷ 78 18600 ÷ 326 635 × 4908

Chapter 2
Fractions



Fractions and Mixed Numbers

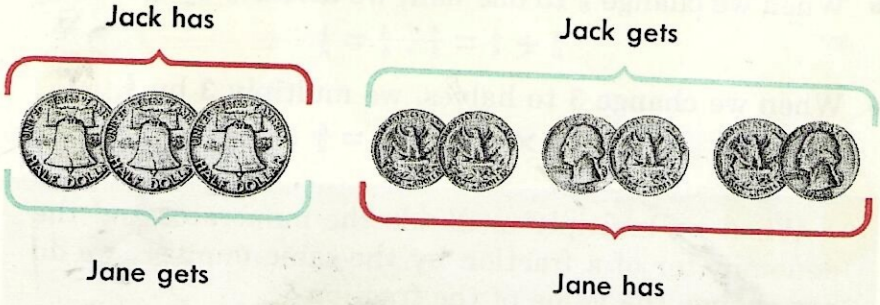
- Let us talk about fractions. A **fraction** is one or more of the equal parts of a whole, as $\frac{1}{2}$ of a circle or $\frac{3}{4}$ of a melon.
- The **denominator** tells the **size** of the parts. The **numerator** tells the **number** of parts. So in $\frac{3}{4}$ there are 3 parts, and the size of each part is a fourth.
- Here are 5 halves ($\frac{5}{2}$). When we have enough parts of any size to make a whole or more, we call the fraction an **improper fraction.**



- When we put together the halves in 5 halves, $\frac{5}{2}$, we get 2 wholes and a half, $2\frac{1}{2}$. We call $2\frac{1}{2}$ a **mixed number.**

Changing Fractions

1. Jack has 3 half dollars. Jane has 6 quarters. Jack wishes to change his half dollars for quarters. How many quarters should he get?



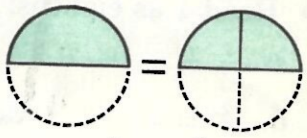
Jack gets twice the number of coins, but the value of each coin is one half as much.

2. Jane wishes to change her 6 quarters for half dollars. How many half dollars should she get?

Jane gets half as many coins, but the value of each coin is doubled.

- When we divide one half into two equal parts, we get two fourths. $\frac{1}{2} = \frac{2}{4}$

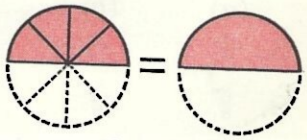
We may say that we changed $\frac{1}{2}$ to $\frac{2}{4}$ by multiplying both the numerator and the denominator by 2. That is what we do in calculating. Actually to change $\frac{1}{2}$ to $\frac{2}{4}$, we double the number of parts which makes the size of each part half as large as it was.



$\frac{1}{2} = \frac{2}{4}$

- When we put 4 eighths together, we get one half. $\frac{4}{8} = \frac{1}{2}$

We may say that we change $\frac{4}{8}$ to $\frac{1}{2}$ by dividing both the numerator and the denominator by 4. That is what we do in calculating. Actually to change $\frac{4}{8}$ to $\frac{1}{2}$, we use one fourth as many parts which makes the size of each part four times as large as it was.



$\frac{4}{8} = \frac{1}{2}$

Changing Fractions

- When we change $\frac{1}{2}$ to fourths, we multiply $\frac{1}{2}$ by $\frac{2}{2}$.

$$\frac{2}{2} \times \frac{1}{2} = \frac{2 \times 1}{2 \times 2} = \frac{2}{4}$$

- When we change $\frac{4}{8}$ to one half, we divide $\frac{4}{8}$ by $\frac{4}{4}$.

$$\frac{4}{8} \div \frac{4}{4} = \frac{4 \div 4}{8 \div 4} = \frac{1}{2}$$

- When we change 3 to halves, we multiply 3 by $\frac{2}{2}$.

$$\frac{2}{2} \times \frac{3}{1} = \frac{2 \times 3}{2 \times 1} = \frac{6}{2}$$

When we multiply or divide the numerator and the denominator of a fraction by the same number, we do not change the value of the fraction.

Here are some pairs of equal fractions. Tell what we do to the numerator and the denominator of the first fraction of each pair to get the second fraction:

	(a)	(b)	(c)	(d)
1.	$\frac{2}{3} = \frac{4}{6}$	$\frac{1}{3} = \frac{3}{9}$	$\frac{1}{4} = \frac{2}{8}$	$\frac{1}{4} = \frac{3}{12}$
2.	$\frac{4}{12} = \frac{1}{3}$	$\frac{3}{4} = \frac{9}{12}$	$\frac{8}{12} = \frac{2}{3}$	$\frac{1}{2} = \frac{5}{10}$
3.	$\frac{1}{2} = \frac{4}{8}$	$\frac{6}{12} = \frac{1}{2}$	$\frac{4}{16} = \frac{1}{4}$	$\frac{6}{9} = \frac{2}{3}$

- Read $\frac{1}{4}$ as eighths: one fourth equals two eighths.

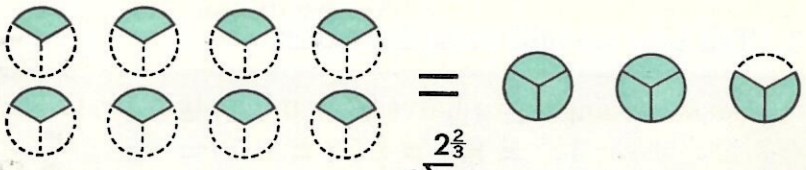
4.	$\frac{1}{4} = \frac{}{8}$	$\frac{3}{4} = \frac{}{8}$	$\frac{3}{4} = \frac{}{12}$	$\frac{3}{4} = \frac{}{16}$
5.	$\frac{2}{3} = \frac{}{6}$	$\frac{6}{12} = \frac{}{2}$	$\frac{9}{12} = \frac{}{4}$	$\frac{4}{6} = \frac{}{3}$
6.	$\frac{1}{2} = \frac{}{6}$	$\frac{1}{2} = \frac{}{4}$	$\frac{1}{2} = \frac{}{8}$	$\frac{1}{2} = \frac{}{10}$
7.	$\frac{2}{6} = \frac{}{3}$	$\frac{6}{9} = \frac{}{3}$	$\frac{2}{5} = \frac{}{10}$	$\frac{1}{6} = \frac{}{12}$

Change to lowest terms:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
8.	$\frac{4}{6}$	$\frac{8}{12}$	$\frac{6}{16}$	$\frac{8}{10}$	$\frac{6}{9}$	$\frac{9}{12}$	$\frac{3}{9}$
9.	$\frac{6}{8}$	$\frac{4}{8}$	$\frac{2}{8}$	$\frac{6}{10}$	$\frac{4}{16}$	$\frac{3}{12}$	$\frac{4}{12}$
10.	$\frac{2}{16}$	$\frac{10}{16}$	$\frac{2}{12}$	$\frac{8}{16}$	$\frac{4}{10}$	$\frac{6}{12}$	$\frac{2}{6}$
11.	$\frac{12}{16}$	$\frac{10}{12}$	$\frac{2}{4}$	$\frac{9}{18}$	$\frac{8}{24}$	$\frac{8}{32}$	$\frac{10}{24}$

Changing Fractions

1. What improper fraction do these thirds of circles show? Since the parts are thirds, how many of them will make a whole?



8 thirds
$\frac{8}{3}$

$$3\overline{)8}\quad 2\tfrac{2}{3}$$
$$\underline{6}$$
$$2$$

2 and 2 thirds
$2\frac{2}{3}$

To change an improper fraction to a mixed number, we group the parts into as many wholes as we can. There are 3 thirds in one whole; so in 8 thirds there will be as many as $8 \div 3$. This is the same as dividing the numerator by the denominator. To change $\frac{8}{3}$ to a mixed number, we divide 8 by 3.

Change these improper fractions to whole numbers or mixed numbers:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
2.	$\frac{9}{2}$	$\frac{12}{5}$	$\frac{50}{12}$	$\frac{18}{3}$	$\frac{17}{4}$	$\frac{16}{9}$	$\frac{20}{3}$
3.	$\frac{15}{2}$	$\frac{8}{4}$	$\frac{10}{9}$	$\frac{19}{6}$	$\frac{14}{5}$	$\frac{17}{8}$	$\frac{35}{16}$

Change each of these fractions to lowest terms:

4.	$\frac{6}{8}$	$\frac{8}{24}$	$\frac{6}{10}$	$\frac{12}{16}$	$\frac{16}{24}$	$\frac{8}{32}$	$\frac{6}{9}$

Read $\frac{2}{3}$ as twelfths; $\frac{3}{5}$ as tenths; and so on:

	(a)	(b)	(c)	(d)
5.	$\frac{2}{3} = \frac{}{12}$	$\frac{3}{5} = \frac{}{10}$	$\frac{1}{4} = \frac{}{12}$	$\frac{5}{8} = \frac{}{16}$
6.	$\frac{1}{3} = \frac{}{15}$	$\frac{3}{4} = \frac{}{20}$	$\frac{16}{24} = \frac{}{3}$	$\frac{10}{25} = \frac{}{5}$

Change the fractions in each set to fractions having parts of the same size:

	(a)	(b)	(c)
7.	$\frac{1}{3}$ and $\frac{3}{4}$	$\frac{2}{3}$ and $\frac{3}{4}$	$\frac{1}{2}$ and $\frac{2}{5}$
8.	$\frac{1}{4}$, $\frac{5}{8}$, and $\frac{1}{2}$	$\frac{2}{3}$, $\frac{3}{4}$, and $\frac{1}{12}$	$\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$

Adding Fractions

• To add fractions, we must first see that the parts are the same size. That is, the fractions must have the same denominator.

1. Tell how we add these fractions:

$\frac{3}{8}$ $\frac{1}{8}$ $\frac{4}{8} = \frac{1}{2}$	$4\frac{5}{12} = 4\frac{5}{12}$ $1\frac{1}{3} = 1\frac{4}{12}$ $5\frac{9}{12} = 5\frac{3}{4}$	$2\frac{1}{2} = 2\frac{6}{12}$ $1\frac{2}{3} = 1\frac{8}{12}$ $3\frac{1}{4} = 3\frac{3}{12}$ $6\frac{17}{12} = 7\frac{5}{12}$

2. Regroup the fractions to make 1. $\frac{3}{4} + \frac{3}{4} = \frac{3}{4} + \frac{1}{4} + \frac{2}{4} = 1\frac{2}{4} = 1\frac{1}{2}$. Write $\frac{1}{2}$ in the sum and add 1 to 5, making the sum $6\frac{1}{2}$.

$$\begin{array}{r} {\scriptstyle 1} \\ 5\frac{3}{4} \\ \frac{3}{4}\ (\frac{1}{4}+\frac{2}{4}) \\ \hline 6\frac{1}{2} \end{array}$$

3.

$4\frac{2}{3}$	$\frac{7}{9}$	$3\frac{7}{8}$	$6\frac{5}{12}$	$\frac{7}{10}$	$6\frac{4}{5}$	$12\frac{5}{6}$
$7\frac{1}{3}$	$7\frac{5}{9}$	$4\frac{3}{8}$	$\frac{11}{12}$	$5\frac{9}{10}$	$4\frac{2}{5}$	$7\frac{5}{6}$

The fractions in these examples do not have like denominators. What must we do before we can add them?

4.

$\frac{1}{2}$	$\frac{7}{10}$	$\frac{3}{5}$	$4\frac{1}{4}$	$\frac{1}{2}$	$8\frac{3}{4}$	$10\frac{7}{8}$
$\frac{3}{8}$	$\frac{1}{5}$	$3\frac{7}{10}$	$3\frac{7}{12}$	$3\frac{1}{6}$	$6\frac{5}{8}$	$5\frac{1}{2}$

5.

$3\frac{5}{6}$	$2\frac{1}{12}$	$4\frac{3}{8}$	$10\frac{1}{12}$	$5\frac{2}{3}$	$7\frac{1}{2}$	$5\frac{3}{8}$
$4\frac{2}{3}$	$4\frac{5}{6}$	$3\frac{1}{4}$	$8\frac{3}{8}$	$2\frac{1}{4}$	$4\frac{1}{3}$	$12\frac{1}{3}$

6.

$7\frac{5}{8}$	$6\frac{1}{2}$	$5\frac{3}{5}$	$1\frac{5}{6}$	$2\frac{2}{3}$	$5\frac{3}{8}$	$6\frac{2}{3}$
$3\frac{9}{10}$	$\frac{2}{3}$	$8\frac{1}{2}$	$12\frac{3}{4}$	$4\frac{3}{4}$	$1\frac{2}{3}$	$2\frac{2}{5}$

7.

$2\frac{3}{4}$	$\frac{1}{2}$	$5\frac{3}{10}$	$2\frac{1}{3}$	$\frac{1}{4}$	$5\frac{1}{4}$	$5\frac{2}{3}$
$1\frac{1}{2}$	$\frac{3}{4}$	$4\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$3\frac{1}{6}$	$8\frac{3}{5}$
$3\frac{2}{3}$	$\frac{7}{8}$	$1\frac{4}{5}$	$3\frac{5}{12}$	$\frac{3}{16}$	$4\frac{1}{2}$	$16\frac{5}{6}$

Subtracting Fractions

• To subtract fractions, we must first see that the parts are the same size. That is, the fractions must have the same denominator.

1. Tell how we subtract these fractions:

$4\frac{1}{6} = 3\frac{7}{6}$ $1\frac{5}{6} = 1\frac{5}{6}$ $2\frac{2}{6} = 2\frac{1}{3}$	$3\frac{1}{4} = 3\frac{3}{12} = 2\frac{15}{12}$ $1\frac{5}{12} = 1\frac{5}{12} = 1\frac{5}{12}$ $1\frac{10}{12} = 1\frac{5}{6}$	$\frac{1}{2} = \frac{3}{6}$ $\frac{1}{3} = \frac{2}{6}$ $\frac{1}{6}$

2. Jane bought $3\frac{1}{2}$ yards of braid. She put $1\frac{2}{3}$ yards of it on a blouse. How many yards of braid were left?

3. Mrs. Willis had $\frac{2}{3}$ cup of cream. She used $\frac{1}{2}$ cup in salad dressing. How much cream had she left?

Subtract. Check by going over your work carefully.

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
4.	$\frac{5}{8}$ $\frac{4}{8}$	$\frac{3}{4}$ $\frac{1}{4}$	$\frac{7}{12}$ $\frac{5}{12}$	$\frac{15}{16}$ $\frac{7}{16}$	$\frac{7}{9}$ $\frac{1}{9}$	$4\frac{7}{10}$ $2\frac{3}{10}$	$6\frac{3}{10}$ $2\frac{9}{10}$
5.	$5\frac{3}{8}$ $4\frac{7}{8}$	$9\frac{8}{9}$ $1\frac{4}{9}$	$6\frac{3}{4}$ 4	$3\frac{4}{5}$ $\frac{2}{5}$	4 $1\frac{1}{2}$	8 $6\frac{3}{5}$	$2\frac{5}{12}$ $\frac{7}{12}$

The fractions in these examples do not have like denominators. What must we do before we can subtract?

6.	$7\frac{2}{3}$ $4\frac{7}{12}$	$3\frac{2}{9}$ $2\frac{2}{3}$	$3\frac{3}{5}$ $1\frac{1}{10}$	$5\frac{1}{2}$ $2\frac{7}{8}$	$7\frac{1}{8}$ $4\frac{3}{4}$	$3\frac{1}{3}$ $1\frac{2}{9}$	$8\frac{1}{4}$ $5\frac{3}{8}$
7.	$8\frac{2}{3}$ $3\frac{5}{9}$	$4\frac{8}{9}$ $2\frac{2}{3}$	$5\frac{1}{3}$ $1\frac{7}{12}$	$7\frac{1}{2}$ $3\frac{3}{4}$	$8\frac{1}{2}$ $6\frac{5}{8}$	$12\frac{1}{8}$ $7\frac{1}{4}$	$6\frac{1}{6}$ $3\frac{1}{2}$
8.	$\frac{5}{6}$ $\frac{2}{3}$	$8\frac{1}{3}$ $7\frac{5}{6}$	$2\frac{3}{5}$ $1\frac{1}{2}$	$3\frac{1}{3}$ $\frac{1}{2}$	$4\frac{1}{3}$ $\frac{3}{4}$	$4\frac{1}{2}$ $1\frac{2}{3}$	$10\frac{2}{9}$ $5\frac{1}{6}$

Do You Know?

Diagnostic Test

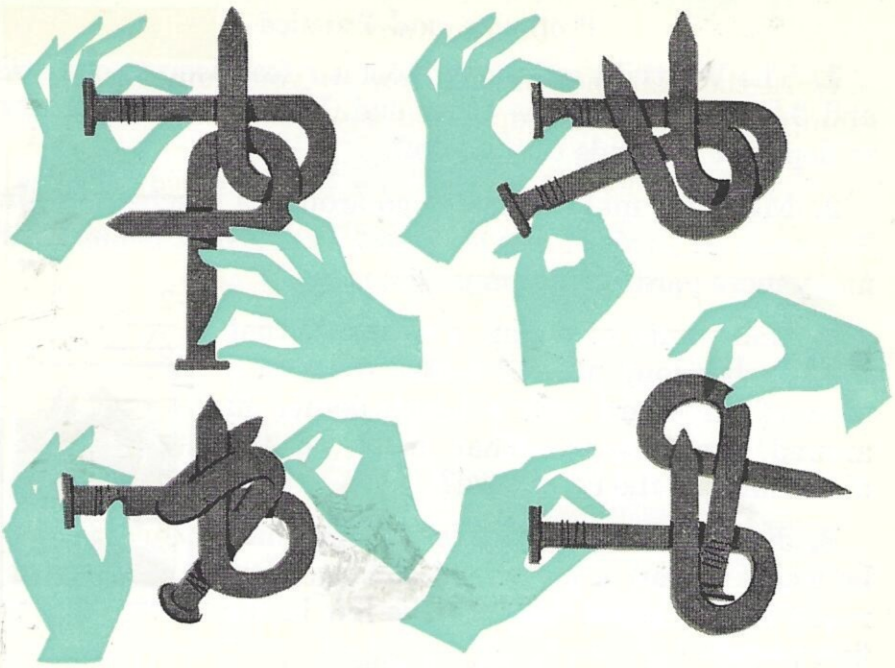
Work the examples in each row. If you cannot work an example, study the example that is worked for you.

Subtracting

	(a)	(b)	(c)	(d)	(e)	Study
1.	$16\frac{3}{4}$ $7\frac{2}{3}$	$29\frac{4}{5}$ $19\frac{1}{3}$	$15\frac{2}{3}$ $6\frac{1}{2}$	$18\frac{1}{3}$ $9\frac{1}{4}$	$26\frac{3}{4}$ $4\frac{1}{5}$	$8\frac{7}{8} = 8\frac{21}{24}$ $2\frac{1}{3} = 2\frac{8}{24}$ $6\frac{13}{24}$
2.	$24\frac{3}{4}$ $9\frac{1}{6}$	$32\frac{1}{4}$ $18\frac{1}{6}$	$40\frac{5}{6}$ $17\frac{3}{4}$	$63\frac{9}{10}$ $28\frac{3}{4}$	$34\frac{7}{10}$ $29\frac{1}{4}$	$17\frac{7}{12} = 17\frac{7}{12}$ $9\frac{1}{4} = 9\frac{3}{12}$ $8\frac{4}{12} = 8\frac{1}{3}$
3.	$91\frac{1}{4}$ $27\frac{2}{3}$	$67\frac{1}{8}$ $39\frac{5}{6}$	$93\frac{5}{6}$ $28\frac{2}{3}$	$11\frac{2}{3}$ $6\frac{3}{4}$	$74\frac{1}{3}$ $29\frac{1}{2}$	$84\frac{1}{2} = 84\frac{3}{6} = 83\frac{9}{6}$ $42\frac{2}{3} = 42\frac{4}{6} = 42\frac{4}{6}$ $41\frac{5}{6}$

Adding

4.	$9\frac{2}{5}$ $4\frac{1}{3}$	$4\frac{1}{8}$ $7\frac{1}{4}$	$8\frac{2}{3}$ $5\frac{1}{9}$	$3\frac{1}{3}$ $8\frac{1}{2}$	$9\frac{1}{4}$ $7\frac{2}{3}$	$7\frac{3}{8} = 7\frac{9}{24}$ $2\frac{1}{3} = 2\frac{8}{24}$ $9\frac{17}{24}$
5.	$8\frac{1}{3}$ $7\frac{1}{6}$ $3\frac{1}{4}$	$8\frac{5}{6}$ $9\frac{1}{10}$ $4\frac{2}{3}$	$9\frac{1}{6}$ $7\frac{1}{3}$ $6\frac{2}{9}$	$5\frac{5}{8}$ $6\frac{2}{3}$ $8\frac{5}{6}$	$7\frac{1}{2}$ $5\frac{3}{8}$ $9\frac{1}{4}$	$6\frac{3}{4} = 6\frac{9}{12}$ $8\frac{1}{6} = 8\frac{2}{12}$ $9\frac{1}{3} = 9\frac{4}{12}$ $23\frac{15}{12} = 24\frac{1}{4}$
6.	$9\frac{4}{5}$ $8\frac{7}{10}$ $6\frac{3}{4}$	$4\frac{3}{10}$ $7\frac{3}{5}$ $9\frac{1}{2}$	$20\frac{9}{16}$ $7\frac{1}{4}$ $43\frac{5}{8}$	$8\frac{2}{3}$ $57\frac{7}{8}$ $6\frac{3}{4}$	$30\frac{1}{2}$ $50\frac{1}{3}$ $30\frac{1}{6}$	$7\frac{1}{10} = 7\frac{6}{60}$ $4\frac{1}{3} = 4\frac{20}{60}$ $2\frac{3}{4} = 2\frac{45}{60}$ $13\frac{71}{60} = 14\frac{11}{60}$



Problem-Solving

A puzzle is a "problem" only if you haven't worked it before. What is a problem in arithmetic? If you know how to work it, is it a "problem"?

1. Barbara practiced her piano lesson each school day for $\frac{1}{2}$ hour after breakfast and $\frac{3}{4}$ hour after school. How long did she practice during a school day?

2. Joe's father sells cherries. He pays Joe at the rate of $2\frac{1}{2}¢$ a box for picking them. If boxes cost on the average $1\frac{1}{8}¢$ each, how much expense is there on each box of cherries?

3. Mrs. Allen has a rug that is $9\frac{3}{4}$ feet long and $6\frac{1}{3}$ feet wide. She wants to put fringe around it. If she allows $2\frac{1}{2}$ feet of fringe for the corners, how many yards of fringe should she buy?

4. Helen bought $2\frac{1}{8}$ yards of material for a dress. When she decided to use a different pattern, she found she needed $3\frac{5}{8}$ yards. How much more material did she need to buy for the dress?

Problems and Practice

1. The Westville swimming pool is 7 feet deep at one end and $3\frac{5}{12}$ feet deep at the other end. What is the difference in depth at the ends of the pool?

2. Marion is making lace to go around a luncheon cloth. She needs $5\frac{1}{4}$ yards of lace and has $2\frac{1}{2}$ yards of it made. How many more yards of lace must she make?

3. Bob wants to mount a snapshot that is $4\frac{1}{2}$ inches long and $3\frac{1}{4}$ inches wide on a piece of cardboard with a $\frac{5}{8}$-inch border all around the picture. What must be the dimensions of the cardboard?

4. Jim has a board 8 feet long from which he wants to saw a piece $1\frac{1}{2}$ feet long. How many feet of board will he have left in the first piece?

Keeping in Practice

Add and check:

	(a)	(b)	(c)	(d)
1.	4	28	360	403
	5	37	109	85
	7	85	276	729
	9	39	480	56
	3	80	578	163
2.	125	$8.03	$135.12	
	46	1.95	86.80	
	9	4.80	274.09	
	70	3.76	90.25	
	94	1.89	73.27	
	368	3.75	400.00	

Subtract and check:

	(e)	(f)	(g)
3.	78	91	163
	35	47	98
4.	263	207	308
	105	192	279

Multiply and check:

5.	85	76	35
	9	8	47
6.	539	310	805
	250	409	180

	(a)	(b)	(c)	(d)
7.	$60\overline{)42240}$	$72\overline{)25920}$	$43\overline{)4601}$	$64\overline{)33664}$

Multiplying Fractions

1. Mary put $\frac{1}{2}$ grapefruit on each of the 4 plates at the table. How many grapefruit did she use?

Four $\frac{1}{2}$'s are how many? $4 \times \frac{1}{2} = \frac{4}{2} = 2$

Multiply. Check by going over your work carefully.

	(a)	(b)	(c)	(d)	(e)
2.	$4 \times \frac{2}{3}$	$7 \times \frac{3}{4}$	$9 \times \frac{1}{4}$	$\frac{1}{4} \times 5$	$\frac{2}{3} \times 7$
3.	$5 \times \frac{3}{8}$	$9 \times \frac{3}{16}$	$6 \times \frac{2}{5}$	$3 \times \frac{7}{8}$	$\frac{1}{2} \times 11$

4. If Mary serves each of 5 people $\frac{1}{2}$ grapefruit, how many grapefruit will she need?

5. If Mary needs $2\frac{1}{2}$ grapefruit for each table, how many would she need for 3 such tables?

To multiply $3 \times 2\frac{1}{2}$, we may change $2\frac{1}{2}$ to $\frac{5}{2}$ and then multiply by 3. Or we may multiply without changing $2\frac{1}{2}$ to an improper fraction.

$$3 \times 2\frac{1}{2} = 3 \times \frac{5}{2} = \frac{15}{2} = 7\frac{1}{2}$$

$$\begin{array}{r} 2\frac{1}{2} \\ 3 \\ \hline 1\frac{1}{2} \\ 6 \\ \hline 7\frac{1}{2} \end{array}$$

Multiply either way:

6.	$2 \times 4\frac{1}{3}$	$3 \times 2\frac{1}{4}$	$4\frac{1}{4} \times 2$	$3\frac{1}{2} \times 5$	$2\frac{1}{8} \times 7$
7.	$4 \times 1\frac{1}{5}$	$1\frac{1}{6} \times 5$	$3\frac{1}{2} \times 3$	$4 \times 2\frac{3}{5}$	$8 \times 3\frac{1}{3}$

8. Mrs. Moss asked her butcher for 7 half-pound steaks. About how many pounds of steak does she want?

9. Ann wants to put $\frac{1}{4}$ pound of candy into each of the favors for her party. She plans to make 18 favors. How many pounds of candy will she need?

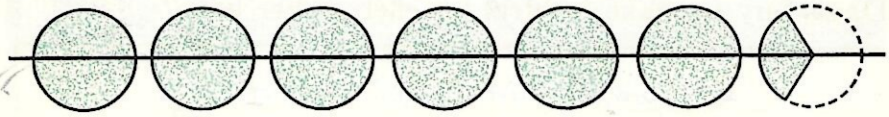
10. Mrs. Allen uses $1\frac{1}{2}$ pounds of butter each week. How many pounds of butter will she use in 4 weeks?

How We Multiply Fractions

Study these examples.

1. How do we multiply 6 by $\frac{1}{2}$? $\frac{1}{2} \times 6 =$ ▨.
Multiplying by $\frac{1}{2}$ is the same as finding $\frac{1}{2}$ of 6.

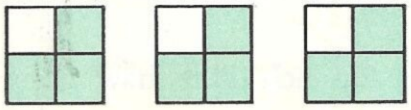
2. How do we multiply $6\frac{1}{3}$ by $\frac{1}{2}$? $\frac{1}{2} \times 6\frac{1}{3} =$ ▨.



$\frac{1}{2} \times 6\frac{1}{3} = \frac{1}{2} \times \frac{19}{3} = \frac{19}{6} = 3\frac{1}{6}$

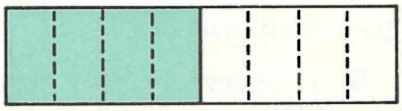
Multiplying by $\frac{1}{2}$ is the same as finding $\frac{1}{2}$ of $6\frac{1}{3}$.

3. $3 \times \frac{3}{4} =$ ▨



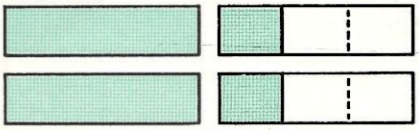
Three $\frac{3}{4}$'s are $2\frac{1}{4}$.
$3 \times \frac{3}{4} = \frac{9}{4} =$ ▨

4. $\frac{1}{4} \times \frac{1}{2} =$ ▨



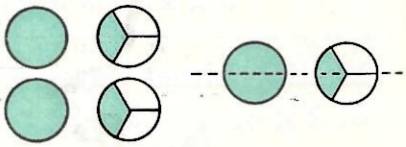
$\frac{1}{4}$ of $\frac{1}{2} = \frac{1}{8}$
$\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$

5. $2 \times 1\frac{1}{3} =$ ▨



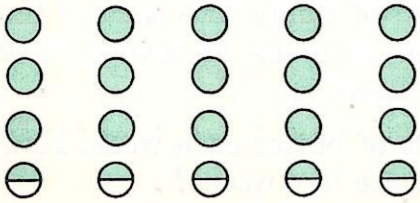
$2 \times 1\frac{1}{3} = 2 \times \frac{4}{3} =$ ▨ = ▨

6. $2\frac{1}{2} \times 1\frac{1}{3} =$ ▨

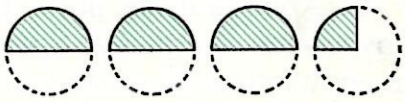


$\frac{5}{2} \times \frac{4}{3} = \frac{20}{6} =$ ▨ = ▨

7. $3\frac{1}{2} \times 5 =$ ▨



8. $3\frac{1}{2} \times \frac{1}{2} =$ ▨



$3\frac{1}{2} \times \frac{1}{2} = \frac{7}{2} \times \frac{1}{2} =$ ▨ = ▨

Multiplying Fractions

Mrs. Davis makes shirts for her 3 boys. One boy wears a size 6; another wears size 10, and the largest boy wears size 14. The table below shows the number of yards of cloth needed for each size.

1. How many yards of cloth 39 inches wide should Mrs. Davis buy to make 3 shirts for each of her boys?

Size	4	6	8	10	12	14	16
Cloth 39 in. wide	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{5}{8}$	$1\frac{3}{4}$	$1\frac{3}{4}$
Cloth 54 in. wide	$\frac{7}{8}$	1	1	$1\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{4}$

Taxicab Rates

The first $\frac{1}{4}$ mile or fraction thereof, one person, 35 cents

Each additional $\frac{2}{5}$ of a mile or fraction thereof, 10 cents

Each additional person 12 years or over for whole trip, 20 cents

Each 3 minutes' waiting time, or fraction thereof, 10 cents

2. How much will it cost to ride in a taxicab for $\frac{1}{2}$ mile? for 2 miles? for $4\frac{1}{4}$ miles?

Multiply:

	(a)	(b)	(c)	(d)	(e)
3.	$\frac{1}{3} \times 2\frac{1}{2}$	$12 \times \frac{3}{8}$	$2\frac{1}{2} \times \frac{1}{2}$	$4\frac{2}{3} \times \frac{1}{5}$	$\frac{8}{9} \times \frac{6}{7}$
4.	$5\frac{1}{4} \times 6$	$3\frac{1}{4} \times \frac{3}{5}$	$\frac{7}{8} \times 1\frac{2}{3}$	$7 \times 2\frac{1}{2}$	$1\frac{1}{3} \times 5$
5.	$2 \times \frac{3}{5}$	$\frac{1}{2} \times \frac{1}{5}$	$\frac{1}{5} \times 24$	$\frac{3}{4} \times 35$	$\frac{5}{8} \times 7$
6.	$\frac{1}{4} \times \frac{1}{5}$	$2 \times 2\frac{2}{3}$	$1\frac{1}{4} \times 3$	$2\frac{1}{4} \times \frac{3}{5}$	$\frac{3}{4} \times 3\frac{2}{3}$
7.	$\frac{3}{10} \times 4\frac{1}{2}$	$\frac{5}{8} \times 1\frac{1}{2}$	$2\frac{1}{8} \times 2\frac{2}{3}$	$4\frac{1}{4} \times 2\frac{1}{5}$	$24 \times \frac{7}{9}$
8.	$8 \times 2\frac{4}{5}$	$6 \times 3\frac{1}{5}$	$\frac{5}{8} \times \frac{4}{15}$	$8\frac{4}{7} \times 2\frac{4}{5}$	$5\frac{5}{6} \times 9$

The Sewing Club

1. The girls in the Sewing Club are going to make aprons. The pattern calls for $1\frac{1}{8}$ yards of material. If they buy the material in one piece, how many yards will be needed for 18 aprons?

2. Ann is going to make her brother Jim a shirt. She needs $2\frac{1}{4}$ yards of material. If the price of the material is 85¢ a yard, how much will the material for the shirt cost?

3. Ann sewed $3\frac{1}{2}$ hours, $4\frac{3}{4}$ hours, and $5\frac{3}{4}$ hours, on Jim's shirt. How many hours did it take her to make the shirt?

4. Betty bought $\frac{1}{3}$ yard of linen to make handkerchiefs. The linen cost $1.80 a yard. How much did she pay for the linen?

5. Susan bought $4\frac{1}{8}$ yards of one piece of cotton material, $3\frac{3}{4}$ yards of linen, and $3\frac{1}{2}$ yards of chambray. How many yards of material did she get in all?

6. Martha had a piece of organdy $2\frac{3}{4}$ yards long. She cut off $1\frac{1}{8}$ yards of it to make an apron. How many yards of organdy were left?

7. Winnie bought a bolt of tape that contained 6 yards. She used $2\frac{1}{2}$ yards of it around the hem of her skirt. How much tape was left?

Dividing before Multiplying

Here we divided both terms of the fraction by 2 after we multiplied.

$$\frac{1}{8} \times \frac{6}{7} = \frac{6}{56} = \frac{3}{28}$$

Here we divided before we multiplied. We crossed out or canceled the numbers we divided.

$$\frac{1}{\cancel{8}_{4}} \times \frac{\overset{3}{\cancel{6}}}{7} = \frac{3}{28}$$

Multiply. Divide first (cancel) when you can.

	(a)	(b)	(c)	(d)
1.	$\frac{1}{12} \times 4$	$16 \times \frac{3}{8}$	$9 \times \frac{4}{5}$	$5 \times \frac{7}{10}$
2.	$2\frac{1}{2} \times 10$	$\frac{5}{8} \times 80$	$\frac{7}{8} \times 7$	$9 \times \frac{1}{6}$
3.	$\frac{9}{16} \times 3$	$18 \times 1\frac{5}{6}$	$4 \times \frac{7}{16}$	$\frac{5}{6} \times 5$
4.	$7 \times \frac{3}{8}$	$\frac{1}{9} \times 54$	$1\frac{2}{3} \times 3\frac{3}{5}$	$\frac{3}{4} \times 5\frac{1}{3}$
5.	$12 \times \frac{3}{4}$	$\frac{1}{6} \times 1\frac{1}{2}$	$1\frac{3}{4} \times 2\frac{4}{5}$	$\frac{3}{5} \times 30$
6.	$4\frac{2}{3} \times \frac{2}{7}$	$3\frac{3}{5} \times \frac{1}{9}$	$2 \times \frac{4}{7}$	$\frac{7}{10} \times 2\frac{1}{2}$
7.	$6 \times 2\frac{1}{2}$	$\frac{8}{9} \times \frac{3}{4}$	$18 \times 6\frac{2}{3}$	$\frac{5}{9} \times 2\frac{3}{4}$
8.	$\frac{3}{8} \times 16$	$\frac{5}{16} \times 5\frac{1}{3}$	$3 \times 4\frac{1}{2}$	$5\frac{1}{2} \times 4$
9.	$3\frac{1}{3} \times 1\frac{1}{3}$	$1\frac{2}{5} \times 2\frac{1}{3}$	$1\frac{1}{2} \times 1\frac{1}{4}$	$2\frac{3}{5} \times 3\frac{1}{4}$
10.	$2\frac{3}{8} \times \frac{1}{9}$	$\frac{4}{5} \times \frac{5}{8}$	$16 \times \frac{5}{8}$	$\frac{4}{9} \times \frac{6}{7}$
11.	$\frac{7}{8} \times 4\frac{1}{6}$	$6\frac{1}{4} \times \frac{1}{2}$	$1\frac{3}{5} \times 3\frac{1}{3}$	$3\frac{1}{2} \times 1\frac{4}{5}$

12. Helen is hemming a lunch cloth that is $1\frac{1}{3}$ yards long and $1\frac{1}{4}$ yards wide. How many yards of hemming must she do?

13. Patty wants to put braid around the collar of a dress. She needs $1\frac{1}{2}$ times the measurement of her collar which is $\frac{3}{4}$ yard. How many yards of braid should she buy?

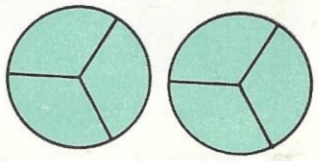
Dividing Fractions

1. If 2 pies are divided into thirds, how many pieces will there be?

We must find how many thirds there are in 2. $2 \div \frac{1}{3}$ asks, "How many thirds are in two?"

There are 3 thirds in one. So in two there are 2×3, or 6 thirds.

Hence, $2 \div \frac{1}{3} = 2 \times 3 = 6$.

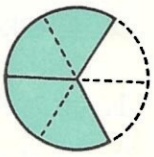


2. If two thirds of a pie are cut into sixths, how many pieces will there be?

$\frac{2}{3} \div \frac{1}{6}$ asks, "How many sixths are in two thirds?"

There are 6 sixths in one. So in two thirds there are $\frac{2}{3} \times 6$, or 4.

Hence, $\frac{2}{3} \div \frac{1}{6} = \frac{2}{3} \times 6 = \frac{1}{3}\frac{2}{} = 4$.



3. How many $\frac{3}{8}$-inch lengths are there in $2\frac{1}{4}$ inches?

To answer the question, we must divide $2\frac{1}{4}$, or $\frac{9}{4}$, by $\frac{3}{8}$. $2\frac{1}{4} \div \frac{3}{8}$ asks, "How many $\frac{3}{8}$'s are in $2\frac{1}{4}$?"

► To divide by a fraction, we invert the divisor and multiply.

$$2\tfrac{1}{4} \div \tfrac{3}{8} = \tfrac{9}{4} \div \tfrac{3}{8} = \frac{\overset{3}{\cancel{9}}}{\underset{1}{\cancel{4}}} \times \frac{\overset{2}{\cancel{8}}}{\underset{1}{\cancel{3}}} = \tfrac{6}{1} = 6$$

Explain how each of these examples was worked:

	(*a*)	(*b*)
4.	$4 \div \frac{1}{2} = 4 \times 2 = 8$	$2\frac{2}{3} \div \frac{2}{9} = \frac{8}{3} \div \frac{2}{9} = \frac{\overset{4}{\cancel{8}}}{\underset{1}{\cancel{3}}} \times \frac{\overset{3}{\cancel{9}}}{\underset{1}{\cancel{2}}} =$ ▨
5.	$\frac{3}{4} \div 2 = \frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$	$9 \div \frac{3}{4} = \overset{3}{\cancel{9}} \times \frac{4}{\underset{1}{\cancel{3}}} =$ ▨
6.	$\frac{2}{3} \div \frac{1}{6} = \frac{2}{\underset{1}{\cancel{3}}} \times \frac{\overset{2}{\cancel{6}}}{1} =$ ▨	$6 \div 2\frac{2}{3} = 6 \div \frac{8}{3} = \overset{3}{\cancel{6}} \times \frac{3}{\underset{4}{\cancel{8}}} =$ ▨
7.	$1\frac{1}{2} \div 3 = \frac{\overset{1}{\cancel{3}}}{2} \times \frac{1}{\underset{1}{\cancel{3}}} =$ ▨	$4\frac{1}{2} \div 1\frac{1}{2} = \frac{9}{2} \div \frac{3}{2} = \frac{\overset{3}{\cancel{9}}}{\underset{1}{\cancel{2}}} \times \frac{1}{\underset{1}{\cancel{3}}} =$ ▨

Practice in Dividing Fractions

Find the answers:

	(a)	(b)	(c)	(d)
1.	$3 \div \frac{1}{6}$	$5 \div \frac{2}{5}$	$6 \div \frac{3}{5}$	$3 \div \frac{3}{4}$
2.	$\frac{7}{8} \div 2$	$\frac{3}{4} \div 5$	$\frac{4}{5} \div 3$	$\frac{5}{8} \div 3$
3.	$\frac{1}{6} \div \frac{3}{8}$	$\frac{3}{4} \div \frac{1}{4}$	$\frac{1}{2} \div \frac{1}{3}$	$\frac{5}{6} \div \frac{3}{4}$
4.	$9 \div \frac{1}{3}$	$10 \div \frac{2}{3}$	$\frac{3}{8} \div 6$	$\frac{3}{4} \div 2$
5.	$\frac{3}{8} \div \frac{3}{16}$	$\frac{2}{3} \div 2$	$8 \div \frac{1}{2}$	$\frac{3}{4} \div \frac{1}{12}$
6.	$3 \div 1\frac{1}{3}$	$4 \div 2\frac{1}{4}$	$25 \div 1\frac{1}{2}$	$8 \div 2\frac{2}{3}$
7.	$12\frac{1}{2} \div 2$	$6\frac{2}{3} \div 4$	$8\frac{1}{3} \div 5$	$4\frac{3}{4} \div 3$
8.	$2\frac{1}{2} \div \frac{2}{3}$	$4\frac{3}{4} \div \frac{5}{8}$	$3\frac{1}{3} \div \frac{3}{4}$	$1\frac{1}{2} \div \frac{3}{16}$
9.	$\frac{1}{2} \div 1\frac{1}{3}$	$\frac{3}{8} \div 2\frac{1}{2}$	$\frac{7}{16} \div 1\frac{3}{4}$	$\frac{11}{12} \div 3\frac{2}{3}$
10.	$3\frac{1}{3} \div 1\frac{1}{2}$	$2\frac{3}{4} \div 1\frac{1}{4}$	$4\frac{1}{8} \div 3\frac{2}{3}$	$3\frac{1}{4} \div 1\frac{1}{4}$
11.	$12 \div \frac{2}{3}$	$\frac{8}{9} \div 4$	$5\frac{1}{2} \div \frac{1}{4}$	$18 \div 3\frac{1}{3}$
12.	$\frac{5}{16} \div \frac{1}{8}$	$1\frac{1}{4} \div 5$	$1\frac{1}{5} \div 8$	$15 \div 2\frac{1}{2}$
13.	$\frac{5}{6} \div 4$	$9 \div \frac{3}{4}$	$\frac{9}{10} \div 1\frac{1}{5}$	$10\frac{1}{2} \div 6$
14.	$12 \div 1\frac{1}{5}$	$3\frac{1}{6} \div \frac{5}{6}$	$1\frac{7}{8} \div 2\frac{1}{2}$	$8\frac{1}{3} \div 10$
15.	$5\frac{2}{3} \div 6$	$\frac{5}{6} \div 2\frac{1}{2}$	$6\frac{2}{3} \div 1\frac{1}{4}$	$12\frac{2}{3} \div 2\frac{1}{4}$

16. Mrs. Wilson has $\frac{2}{3}$ of a yard of ribbon. How many pieces $\frac{1}{6}$ of a yard long can she cut?

17. Mrs. Reed has $14\frac{1}{4}$ yards of corduroy for 3 dresses. How many yards will she allow for each dress?

18. Mary has 2 yards of lace for trimming collars. If each collar takes $\frac{2}{3}$ of a yard, how many collars can she make?

19. Mrs. Lewis bought 10 yards of toweling. How many towels can she make if each towel is $\frac{5}{6}$ yard long?

Carpenters at Work

1. For the shelves of his bookcase Ted needs 3 boards, each of which is $2\frac{1}{2}$ feet long. How long a board should he buy?

2. Bill needs three pieces of board that are $3\frac{3}{4}$ feet, $2\frac{7}{8}$ feet, and $1\frac{2}{3}$ feet in length. How many feet of board does he need in all?

3. Jack has a board $10\frac{1}{2}$ feet long. He wants to cut it into pieces $1\frac{1}{2}$ feet long. How many pieces will he get? Will there be any of the board left over?

4. Pat has a board $13\frac{1}{3}$ feet long. He wants to cut it into 5 equal pieces. How long will each piece be?

5. Tom has a board $10\frac{3}{4}$ feet long. If he cuts off 2 pieces that are $3\frac{1}{3}$ feet long and $2\frac{1}{2}$ feet long, how long will the remaining piece be?

6. Jim's board is $8\frac{2}{3}$ feet long. If he saws it into 6 equal pieces, how long will each piece be?

7. Sam bought a 12-foot board. He needs 3 pieces of wood, each of which is $3\frac{3}{4}$ feet long. What length of his board will be wasted?

The Hiking Club

1. The members of the Hiking Club walked $4\frac{1}{2}$ miles on Saturday morning and $3\frac{3}{4}$ miles on Saturday afternoon. How many miles did they walk that Saturday?

2. On Sunday the members planned to walk 10 miles. They walked $4\frac{1}{8}$ miles in the morning and $4\frac{3}{4}$ miles in the afternoon. How many miles less than 10 miles did they walk?

3. On the 4 Saturdays in March the members of the club walked $7\frac{7}{8}$ miles, $6\frac{1}{2}$ miles, $8\frac{3}{4}$ miles, and $8\frac{1}{2}$ miles. How many miles did they walk in the 4 days?

4. What was the average number of miles that the members walked each Saturday in March?

5. John lives $1\frac{1}{2}$ miles from school. He goes to his grandmother's house for lunch each day. She lives $\frac{1}{4}$ mile from school. John walks to and from school and to and from his grandmother's each day. How many miles will he walk each school week?

6. Joe walked $3\frac{1}{2}$ miles from his home to Jack's home. They both walked $1\frac{1}{8}$ miles to the circus. They returned to Jack's home for dinner. Then Joe walked home alone. How much farther did Joe walk on the trip than Jack?

Do You Know Fractions? Diagnostic Test

Work the test examples. If you make a mistake, use the study pages, then work the practice examples in that row.

	Test				Study	Practice			
	Add:								
	(a)	(b)	(c)	(d)		(e)	(f)	(g)	(h)
1.	$\frac{3}{8}$ $\frac{3}{8}$	$\frac{7}{12}$ $\frac{5}{12}$	$\frac{4}{5}$ $\frac{4}{5}$	$\frac{9}{10}$ $\frac{7}{10}$	26	$\frac{11}{15}$ $\frac{8}{15}$	$\frac{1}{8}$ $\frac{3}{8}$	$\frac{9}{16}$ $\frac{7}{16}$	$\frac{5}{6}$ $\frac{5}{6}$
2.	$\frac{3}{4}$ $\frac{1}{2}$ $\frac{1}{8}$	$\frac{7}{8}$ $\frac{3}{4}$ $\frac{11}{16}$	$\frac{2}{3}$ $\frac{3}{4}$ $\frac{5}{6}$	$6\frac{5}{8}$ $4\frac{1}{6}$ $6\frac{1}{3}$		$\frac{1}{10}$ $\frac{1}{2}$ $\frac{1}{5}$	$\frac{3}{8}$ $\frac{5}{6}$ $\frac{3}{4}$	$\frac{5}{16}$ $\frac{2}{3}$ $\frac{3}{4}$	$6\frac{3}{8}$ $9\frac{5}{6}$ $3\frac{2}{3}$
	Subtract:								
3.	$\frac{7}{9}$ $\frac{1}{9}$	$\frac{7}{8}$ $\frac{1}{4}$	$\frac{5}{6}$ $\frac{1}{3}$	$\frac{3}{4}$ $\frac{1}{3}$	27	$\frac{5}{6}$ $\frac{1}{6}$	$\frac{15}{16}$ $\frac{1}{4}$	$\frac{11}{12}$ $\frac{3}{4}$	$\frac{9}{10}$ $\frac{2}{3}$
4.	$1\frac{3}{8}$ $\frac{3}{4}$	$7\frac{3}{5}$ $\frac{7}{10}$	$13\frac{5}{6}$ $8\frac{11}{12}$	$16\frac{3}{8}$ $9\frac{2}{3}$		$1\frac{2}{5}$ $\frac{7}{10}$	$8\frac{3}{8}$ $\frac{15}{16}$	$15\frac{1}{2}$ $9\frac{4}{9}$	$13\frac{1}{3}$ $6\frac{5}{6}$
	(a)	(b)				(c)		(d)	
5.	$3 \times \frac{5}{6}$	$\frac{3}{8} \times 6$			31	$2 \times \frac{7}{12}$		$\frac{11}{12} \times 2$	
6.	$\frac{5}{6} \times \frac{9}{10}$	$\frac{5}{6} \times \frac{5}{9}$			32 33	$\frac{3}{4} \times \frac{8}{15}$		$\frac{9}{10} \times \frac{3}{8}$	
7.	$3\frac{1}{2} \times 8$	$6\frac{2}{3} \times 5\frac{3}{4}$				$6 \times 9\frac{1}{3}$		$8\frac{1}{2} \times 7\frac{1}{3}$	
8.	$\frac{5}{6} \div 5$	$\frac{4}{5} \div 3$			36	$\frac{9}{10} \div 3$		$\frac{11}{12} \div 2$	
9.	$9 \div \frac{1}{4}$	$16 \div \frac{8}{9}$				$6 \div \frac{1}{4}$		$15 \div \frac{3}{4}$	
10.	$\frac{3}{4} \div \frac{1}{8}$	$\frac{9}{10} \div \frac{3}{5}$				$\frac{5}{6} \div \frac{2}{3}$		$\frac{7}{8} \div \frac{3}{5}$	
11.	$3\frac{1}{2} \div 7$	$9\frac{3}{4} \div 2\frac{1}{3}$				$6\frac{2}{3} \div 8$		$8\frac{3}{4} \div 2\frac{2}{3}$	

The Fun Club Party

1. The boys are helping the girls of the Fun Club to get ready for a party. They decided to allow $\frac{1}{8}$ of a batch of candy per person. There were to be twenty-four people at the party. How many batches of candy should they make?

2. They need 2 pounds of peanuts for the candy. How many people will have to bring $\frac{1}{2}$ pound of peanuts to have enough for the candy?

3. They found a recipe for punch, but it gave the amounts needed to serve 100 persons. They decided to use three eighths of the amounts stated. How much of each ingredient should they buy?

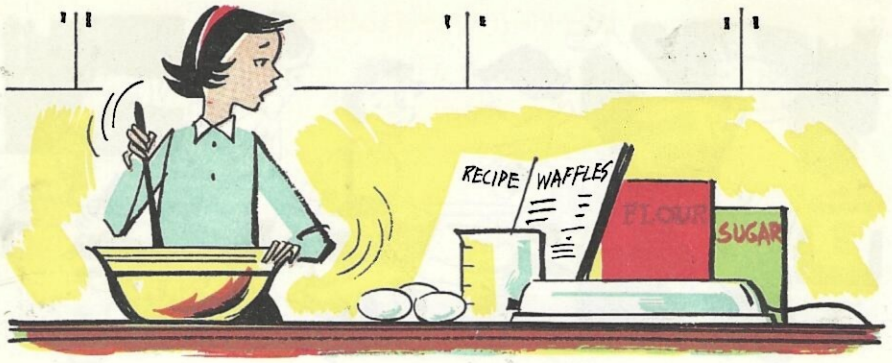
Punch
(for 100 people)

24 qt. gingerale	3 gal. ice cream
Juice of 12 oranges	Juice of 6 lemons

4. The committee figured that they needed $\frac{1}{6}$ pound of meat for each hamburger. They bought $8\frac{1}{2}$ pounds of meat. Did they have enough to make 2 hamburgers for each person?

5. They allowed $\frac{1}{16}$ pound of butter for each person. How many pounds of butter were needed for the 24 people?

6. If the committee planned for $\frac{1}{6}$ dozen rolls for each person, how many dozen rolls did they need to buy? How many rolls would each person be allowed?



Problems

1. Mary has a waffle recipe that makes 6 waffles. Write the recipe to make 2 waffles.

Waffles

$1\frac{3}{4}$ cups cake flour
3 teaspoons baking powder
$\frac{1}{2}$ teaspoon salt
1 tablespoon sugar
3 eggs
$1\frac{1}{2}$ cups milk
5 tablespoons melted butter

2. Gerry's dog eats $\frac{2}{3}$ of a can of dog food each day. How many cans are needed for a week's supply? At 15¢ per can how much does the dog food cost for a week?

3. Mrs. Allen allows $\frac{3}{4}$ of a cup of sugar to each quart of fruit that she cans. She canned 14 quarts of cherries, 24 quarts of peaches, and 16 quarts of pears. How many cups of sugar did she use?

4. Sugar costs 11¢ a pound. How much did the sugar for Mrs. Allen's canned fruit amount to? (2 cups = 1 pound)

5. Mrs. Jones has 7 yards of linen. If she cuts off $2\frac{7}{8}$ yards to make a dress for Sue, how many yards of linen will be left?

6. Mr. Cobb, who owns a restaurant, gives the pieces of pie that are left over to the orphanage when he is ready to close at midnight. One day he had left $\frac{4}{5}$ of an apple pie, $\frac{2}{5}$ of a cherry pie, $\frac{2}{5}$ of a lemon pie, and $\frac{1}{5}$ of a mincemeat pie. How many pies did he give away?

Working with Fractions

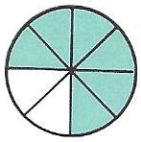
• It is good practice to work with fractions without the use of pencil and paper when you can. Write only the answers. Check each example by working it a second time.

	(a)	(b)	(c)	(d)
1.	$\frac{1}{4} + \frac{1}{8}$	$2\frac{1}{3} + \frac{1}{2}$	$3\frac{7}{8} + 2$	$\frac{7}{8} + \frac{3}{4}$
2.	$\frac{2}{3} + \frac{3}{4}$	$3\frac{3}{8} + \frac{1}{4}$	$4\frac{3}{4} + 3$	$2\frac{1}{4} + 1\frac{1}{2}$
3.	$2\frac{1}{4} + \frac{3}{8}$	$\frac{1}{8} + 1\frac{5}{8}$	$3\frac{1}{4} + 4\frac{1}{16}$	$2\frac{3}{4} + 3\frac{1}{8}$
4.	$\frac{2}{3} + \frac{1}{2}$	$1\frac{3}{4} + 2\frac{3}{4}$	$2\frac{1}{3} + 1\frac{5}{6}$	$1\frac{1}{2} + 1\frac{1}{6}$
5.	$2\frac{1}{2} + \frac{3}{8}$	$2\frac{3}{4} + 1\frac{1}{2}$	$\frac{3}{4} + \frac{1}{2}$	$4\frac{7}{8} + 2\frac{1}{2}$
6.	$\frac{1}{3} - \frac{1}{6}$	$2\frac{1}{2} - 1\frac{1}{4}$	$2 - 1\frac{1}{3}$	$2 - \frac{3}{4}$
7.	$\frac{1}{2} - \frac{3}{8}$	$\frac{7}{10} - \frac{1}{2}$	$9 - \frac{5}{6}$	$5\frac{5}{8} - 3\frac{1}{2}$
8.	$\frac{5}{6} - \frac{1}{3}$	$6\frac{7}{12} - 4\frac{1}{4}$	$7\frac{9}{16} - 4\frac{1}{2}$	$4\frac{1}{3} - 2\frac{2}{3}$
9.	$3 - 1\frac{1}{6}$	$\frac{2}{3} - \frac{1}{9}$	$5\frac{1}{3} - 1$	$4\frac{1}{4} - 1\frac{1}{2}$
10.	$1 - \frac{2}{3}$	$8\frac{3}{5} - 5$	$9\frac{3}{8} - 3\frac{1}{4}$	$1\frac{2}{3} - \frac{3}{4}$
11.	$\frac{3}{8} \times 3$	$\frac{3}{4} \times \frac{2}{3}$	$6 \times 1\frac{1}{3}$	$1\frac{3}{4} \times 2$
12.	$\frac{4}{5} \times \frac{3}{8}$	$\frac{1}{2} \times 5$	$8 \times 2\frac{1}{4}$	$3\frac{1}{3} \times 9$
13.	$\frac{1}{4} \times \frac{6}{7}$	$14 \times 3\frac{1}{7}$	$\frac{2}{3} \times \frac{9}{10}$	$\frac{2}{5} \times \frac{5}{8}$
14.	$1\frac{1}{2} \times \frac{1}{2}$	$\frac{1}{4} \times 8$	$1\frac{1}{4} \times 1\frac{1}{4}$	$\frac{1}{4} \times 20$
15.	$1\frac{7}{8} \times 8$	$10 \times \frac{1}{4}$	$2\frac{1}{3} \times 1\frac{3}{4}$	$\frac{3}{8} \times 6$
16.	$\frac{3}{4} \div \frac{1}{4}$	$2\frac{1}{2} \div 5$	$2\frac{1}{2} \div \frac{1}{2}$	$2\frac{1}{2} \div 1\frac{1}{4}$
17.	$\frac{1}{4} \div 9$	$10 \div \frac{1}{5}$	$10 \div 2\frac{1}{2}$	$\frac{1}{2} \div \frac{1}{4}$
18.	$1\frac{3}{4} \div 2$	$1\frac{3}{4} \div \frac{1}{2}$	$8 \div \frac{1}{3}$	$\frac{1}{3} \div 8$
19.	$\frac{3}{8} \div 2$	$2\frac{2}{3} \div 4$	$\frac{2}{3} \div \frac{1}{2}$	$\frac{9}{16} \div 3$
20.	$\frac{5}{6} \div 10$	$\frac{5}{6} \div \frac{1}{10}$	$\frac{2}{3} \div \frac{3}{4}$	$\frac{1}{2} \div \frac{1}{8}$
21.	$\frac{1}{8} \div \frac{5}{8}$	$4 \div \frac{5}{6}$	$5 \div 2\frac{1}{2}$	$1\frac{1}{3} \div 4$

Do You Know Fractions?

Progress Test

1. How do we change $\frac{6}{8}$ to $\frac{3}{4}$? How do we change fractions to lowest terms?



2. Change these fractions to lowest terms:

$\frac{6}{9}$ $\frac{4}{10}$ $\frac{4}{6}$ $\frac{12}{16}$ $\frac{5}{10}$ $\frac{6}{12}$ $\frac{16}{24}$ $\frac{14}{21}$

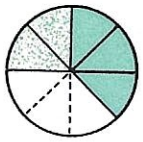
3. Which fraction in each pair is larger?

$\frac{1}{2}$ or $\frac{1}{3}$ $\quad$ $\frac{1}{4}$ or $\frac{1}{3}$ $\quad$ $\frac{1}{4}$ or $\frac{1}{2}$ $\quad$ $\frac{2}{3}$ or $\frac{3}{4}$ $\quad$ $\frac{2}{3}$ or $\frac{4}{5}$

$\frac{3}{4}$ or $\frac{4}{5}$ $\quad$ $\frac{3}{8}$ or $\frac{1}{2}$ $\quad$ $\frac{5}{9}$ or $\frac{2}{3}$ $\quad$ $\frac{7}{8}$ or $\frac{9}{16}$ $\quad$ $\frac{2}{3}$ or $\frac{7}{12}$

4. How do we add like fractions?

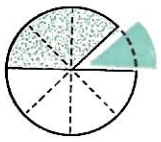
5. How do we add $\frac{1}{4}$ and $\frac{3}{8}$? How do we add unlike fractions?



$\frac{1}{4} + \frac{3}{8}$

Add:

	(a)	(b)	(c)	(d)	(e)	(f)
6.	$6\frac{1}{5}$	$5\frac{3}{8}$	$3\frac{2}{3}$	$9\frac{3}{4}$	$\frac{3}{5}$	$8\frac{2}{3}$
	$2\frac{3}{5}$	$2\frac{7}{8}$	$7\frac{5}{12}$	$4\frac{5}{16}$	$\frac{1}{2}$	$5\frac{3}{4}$
7.	$\frac{1}{2}$	$3\frac{2}{3}$	$2\frac{5}{8}$	$\frac{7}{12}$	$1\frac{2}{3}$	$5\frac{7}{8}$
	$\frac{1}{3}$	$4\frac{1}{2}$	$6\frac{3}{4}$	$\frac{1}{6}$	$3\frac{1}{4}$	$1\frac{5}{6}$
	$\frac{1}{4}$	$1\frac{3}{4}$	$2\frac{1}{2}$	$\frac{2}{3}$	$2\frac{5}{6}$	$3\frac{3}{4}$

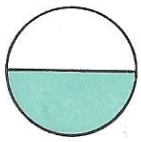


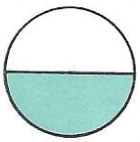
$\frac{1}{2} - \frac{1}{8}$

8. How do we subtract $\frac{1}{8}$ from $\frac{1}{2}$? How do we subtract unlike fractions?

Subtract:

9.	$\frac{5}{6}$	$3\frac{7}{8}$	9	6	$12\frac{1}{4}$	$18\frac{2}{3}$
	$\frac{1}{6}$	$1\frac{1}{4}$	$2\frac{3}{4}$	$\frac{2}{3}$	$9\frac{3}{4}$	$13\frac{3}{4}$
10.	$11\frac{4}{5}$	$7\frac{1}{2}$	$15\frac{2}{3}$	$5\frac{1}{6}$	$10\frac{2}{5}$	$16\frac{1}{8}$
	$10\frac{1}{2}$	$6\frac{2}{3}$	$\frac{5}{6}$	$3\frac{3}{8}$	$4\frac{4}{5}$	$8\frac{1}{4}$





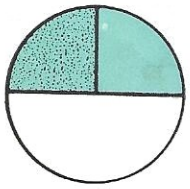
$\frac{1}{2} \times 2$

11. How do we multiply 2 by $\frac{1}{2}$? How do we multiply a fraction by a fraction?

Multiply:

	(a)	(b)	(c)	(d)
12.	$8 \times \frac{1}{2}$	$12 \times \frac{2}{3}$	$\frac{4}{5} \times 10$	$\frac{7}{8} \times 12$
13.	$\frac{5}{6} \times \frac{4}{5}$	$\frac{3}{8} \times 1\frac{1}{3}$	$\frac{15}{16} \times 2\frac{2}{3}$	$5\frac{1}{2} \times \frac{8}{9}$
14.	$4\frac{1}{2} \times 3\frac{1}{3}$	$10\frac{4}{5} \times 3\frac{3}{4}$	$16 \times 1\frac{1}{16}$	$25 \times 2\frac{1}{10}$

15. How do we divide $\frac{1}{2}$ by 2? How do we divide a fraction by a whole number?



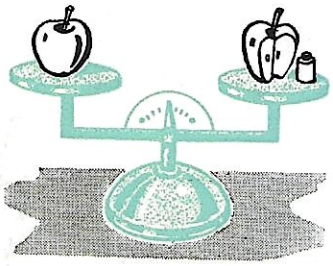
16. How do we divide a fraction by a fraction?

Divide:

17.	$5 \div \frac{1}{4}$	$9 \div \frac{2}{3}$	$\frac{3}{5} \div 2$	$\frac{7}{12} \div 5$
18.	$\frac{3}{4} \div \frac{1}{6}$	$2\frac{2}{3} \div 4$	$6\frac{3}{4} \div 6$	$8 \div 1\frac{1}{3}$

19. The best description of canceling is (*a*) crossing out two numbers; (*b*) dividing a numerator and a denominator by the same number.

20. Look at the scales. Notice that the apple on one side of the scales balances $\frac{3}{4}$ of an apple of the same weight and a $\frac{3}{4}$-ounce weight on the other side of the scales. How much does the whole apple weigh?



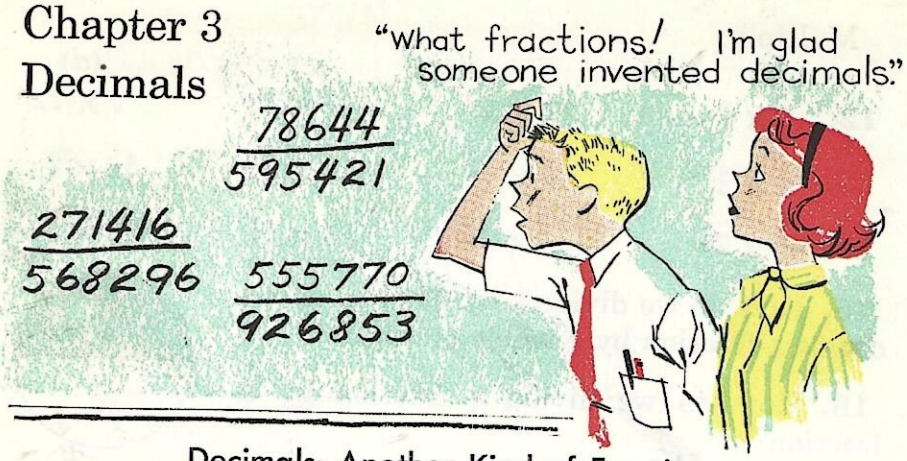
21. If both terms of the fraction $\frac{3}{8}$ are multiplied by 2, is the resulting fraction equal to $\frac{3}{8}$?

22. What does the denominator of $\frac{3}{8}$ show? What does the numerator show?

23. If both terms of the fraction $\frac{24}{36}$ are divided by 6, is the resulting fraction equal to $\frac{24}{36}$? Why?

24. How does the size of the parts in $\frac{6}{16}$ compare with the size of the parts in $\frac{3}{8}$? How do the number of parts in $\frac{6}{16}$ compare with the number in $\frac{3}{8}$?

Chapter 3
Decimals



Decimals: Another Kind of Fraction

• Old arithmetics found in Europe years ago used very large fractions as $\frac{27563}{157624}$, and pupils worked and struggled with these monstrosities. Such cumbersome and meaningless fractions had to be used because decimal fractions had not been invented. Later our decimal number system was extended to include decimals.

• We may think of one's place as the center of our number system. For every place to the left of one's place, there is a place to the right that corresponds to it. Notice how the names of the places tell us this: tens and tenths, hundreds and hundredths, thousands and thousandths, and so on.

Place Names	millions	hundred-thousands	ten-thousands	thousands	hundreds	tens	ones	CENTER	tenths	hundredths	thousandths	ten-thousandths	hundred-thousandths	millionths
	6	, 1	0	4	, 3	9	7	.	2	5	6	, 8	0	7
Value	1,000,000	100,000	10,000	1,000	100	10	1		$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10,000}$	$\frac{1}{100,000}$	$\frac{1}{1,000,000}$

• The decimal point indicates the end of the whole number and the beginning of the fraction.

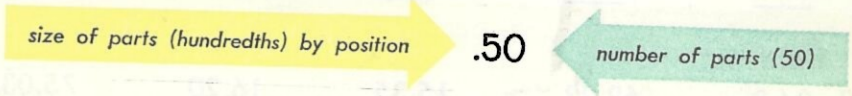
1. The value of each place in a whole number is how many times as great as the value of the place to its right? as the value of the place to its left?

2. What is the value of the place to the right of one's place? the next place to the right? the third place to the right?

• There is the same relation between the values of the places of a decimal and of a whole number. The value of any place in a number is 10 times the value of the place to its right and one tenth of the value of the place to its left.

• Decimal fractions differ from common fractions in two important ways: (1) the denominator of a decimal fraction is always 10 or a multiple of 10, as 100, 1000, and so on; (2) a decimal makes use of place value so that we need not write the denominator.

• In writing decimal fractions we must consider the ideas of size and of number of parts. We write the figures to indicate the number of parts; we use position to indicate the size of the parts. The form .5 indicates **five tenths.** The figure 5 indicates **five,** and its position in tenth's place indicates **tenths,** the size of the parts.



3. What size are the parts and how many parts are there in .05? in .9? in .101?

4. What two things do the figures in a decimal fraction tell?

• We read 6.7 as six and seven tenths. We say the word **and** to tell that our quantity is a whole number and a part. We say **and** only between the wholes and the parts.

5. Read these numbers:

845.4 7.83 1.375 9.005 249.64 4.07

Adding and Subtracting Decimals

The decimal form of a fraction simplifies our work. It makes computations easier.

We add and subtract tenths, hundredths, and thousandths the way we add and subtract ones. We write each part of the answer in its proper place. Remember, in adding or subtracting decimals, we add or subtract numbers having the same place value.

tens	ones	tenths	hundredths	thousandths
2	1.	5	6	4
		9.	4	7
5		8.	0	6
6		6.	8	4

Write in columns and add:

	(a)	(b)
1.	5.84 + 3.25 + 6.42	3.75 + .56 + 8.60 + .79
2.	25.0 + 2.8 + 47.9	.296 + .057 + .180 + .005
3.	.49 + 3.56 + 9.62	8.070 + .035 + .630 + 1.535
4.	1.6 + 5.9 + 3.0	19.381 + 7.009 + .536 + .105

	(a)	(b)	(c)	(d)	(e)
5.	4.30	4.76	4.8	4.185	1.125
	.66	9.33	16.0	2.006	6.375
	.97	.20	35.5	8.900	4.667
	7.03	8.48	9.1	2.050	3.333
	3.55	.07	17.4	9.107	1.166

Subtract:

6.	24.8	62.23	15.35	16.20	75.034
	8.6	24.35	9.27	7.25	3.086
7.	73.0	18.05	54.81	45.00	82.407
	35.6	9.51	27.94	28.07	9.830

Find the answers:

	(a)	(b)	(c)
8.	28.35 − 12.26	65.00 − 9.74	19.30 − 13.75
9.	18.5 + 38.4	6.08 − 4.24	20.83 + 15.67
10.	20.00 − 13.09	.510 + .676	372.9 + 86.1

Multiplying Decimals

• We multiply tenths, hundredths, and thousandths the way we multiply ones. We write each part of our answer in its proper place and place the decimal point correctly.

1. How do we multiply a decimal by a whole number?

$7 \times \frac{6}{10} = \frac{42}{10} = 4\frac{2}{10}$ $\qquad$ $7 \times .6 = 4.2$

2. Multiply .09 by 5. Multiply .005 by 4.

3. How do we multiply a decimal by a decimal?

► When we multiply tenths by tenths, we get hundredths.

$.3 \times .4 = .12$ $\qquad$ $\frac{3}{10} \times \frac{4}{10} = \frac{12}{100}$

► When we multiply tenths by hundredths, we get thousandths.

$.3 \times .04 = .012$ $\qquad$ $\frac{3}{10} \times \frac{4}{100} = \frac{12}{1000}$

► When we multiply hundredths by hundredths, we get ten thousandths.

$.03 \times .04 = .0012$ $\qquad$ $\frac{3}{100} \times \frac{4}{100} = \frac{12}{10000}$

When we multiply decimals, we add the number of decimal places in the multiplicand and multiplier to find the number of places to point off in the product.

Why do we point off 3 places?

$$\begin{array}{r} 4.6 \\ .65 \\ \hline 230 \\ 276 \\ \hline 2.990 \end{array}$$

Multiply:

	(a)	(b)	(c)	(d)	(e)	(f)
4.	.65 × 4.6	7.9 × 3.5	.63 × .07	9.4 × .78	5.43 × 2.7	3.1416 × 1.8
5.	.75 × .8	.75 × .96	8.4 × 5.9	9.5 × 7.8	26.8 × .57	6.93 × 4.6
6.	7.8 × 5	4.36 × 7	5.834 × 9	76 × .5	60 × .7	5.85 × 7.9

Multiplying and Dividing by 10, 100, 1000

1. When we multiply a number by 10, how many places to the right do we move the decimal point?

$10 \times 6.5 = 65.0$
$10 \times 6.75 = 67.50$
$100 \times 6.5 = 650.0$

$100 \times 6.75 = 675.00$
$1000 \times 6.5 = 6500.0$
$1000 \times 6.75 = 6750.00$

2. When we multiply by 100, how many places to the right do we move the decimal point?

3. When we multiply by 1000, how many places to the right do we move the decimal point?

► When we multiply a number by 10, 100, or 1000, we move the decimal point as many places to the right as there are zeros in the multiplier. We annex zeros if they are needed.

4. When we divide a number by 10, how many places to the left do we move the decimal point?

$1.560 \div 10 = .156$
$1.560 \div 100 = .0156$

$1.560 \div 1000 = .00156$

5. When we divide a number by 100, how many places to the left do we move the decimal point?

6. When we divide a number by 1000, how many places to the left do we move the decimal point?

► When we divide a number by 10, 100, or 1000, we move the decimal point as many places to the left as there are zeros in the divisor. We use zeros in the answer where they are needed to keep positions clear.

	(*a*)	(*b*)	(*c*)
7.	$100 \times .0397$	10×60.8	$1000 \times .3462$
8.	1000×35.87	$100 \times .028$	1000×164.4
9.	$34.2 \div 10$	$2.5 \div 1000$	$6.07 \div 100$
10.	$76.05 \div 1000$	$89 \div 10$	$309.4 \div 1000$

Answer in Nearest Whole Number

1. Let us divide 7299 by 24, getting our answer to nearest whole number.

The number does not divide evenly. Since we want our answer to nearest whole, we must carry our division one more place or to tenths. We annex 0 in tenth's place in the dividend. Our answer (304.1) is nearer 304 than 305; so we drop the .1, making our answer 304.

$$\begin{array}{r} 304.1 \\ 24\overline{)7299.0} \\ 72 \\ \hline 99 \\ 96 \\ \hline 30 \\ 24 \\ \hline \end{array}$$

Divide, finding each answer in nearest whole:

	(*a*)	(*b*)	(*c*)	(*d*)
2.	$35\overline{)1788}$	$54\overline{)872}$	$63\overline{)850}$	$34\overline{)725}$
3.	$56\overline{)1176}$	$43\overline{)3196}$	$85\overline{)4370}$	$71\overline{)5826}$
4.	$53\overline{)11885}$	$81\overline{)70937}$	$24\overline{)98956}$	$53\overline{)32870}$

Divide, finding the answer in nearest cent:

5.	$62\overline{)\$334.80}$	$28\overline{)\$56.39}$	$12\overline{)\$49.68}$	$72\overline{)\$259.40}$
6.	$64\overline{)\$202.24}$	$36\overline{)\$369.00}$	$52\overline{)\$468.49}$	$93\overline{)\$187.90}$

Traveling in an aluminum capsule 8 feet high, 3 feet in diameter, attached to a plastic balloon, Maj. David G. Simons of the U.S. Air Force soared to a record altitude of 100,000 feet.

7. How high did Maj. Simons soar to the nearest whole mile?

Dividing Decimals

1. When we divide a number containing a decimal by a whole number, how many places do we point off in the quotient?

Tell where to place the decimal point:

	(*a*)	(*b*)	(*c*)
2.	$6\overline{)3.36}$	$6\overline{).336}$	$9\overline{)43.2}$
3.	$55\overline{)2.970}$	$25\overline{)1.00}$	$19\overline{).1273}$

$$8\overline{)6.72}\quad .84,\ 64,\ 32,\ 32$$

- Remember, in the writing of decimals (parts) as well as in wholes, we use the zero, as we need it, to hold position and to keep positions clear.

4. Often a divisor contains a decimal. Then we change it to a whole number. How can we do this without changing the relation between divisor and dividend?

$$.7\overline{).56}\quad .8,\ 56$$

5. The area of a rectangle is 20.0 square feet. The rectangle is 5.4 feet long. How wide is it?

$5.4\overline{)20.00}$ SENSIBLE — 3.70; 16 2; 3 8 0; 3 7 8; 20

Answer: 3.7 ft.

The answer 3.7 feet assumes no greater accuracy than the measure of the length.

$5.4\overline{)20.0000}$ FOOLISH — 3.7037; 16 2; 3 8 0; 3 7 8; 200; 162; 380; 378

Find the quotient to the same accuracy as the dividend:

	(*a*)	(*b*)	(*c*)
6.	$5.966 \div .19$	$341.04 \div 8.4$	$12.6 \div .36$
7.	$54.6 \div .028$	$11.9 \div .14$	$4.725 \div 7.5$
8.	$.132 \div .06$	$.1258 \div 3.4$	$2.744 \div .49$

Practice with Decimals

Divide. Express the quotients in nearest hundredth.

	(a)	(b)	(c)
1.	$32\overline{)1149.24}$	$51\overline{)399.13}$	$62\overline{)979.6}$
2.	$24\overline{)152.448}$	$.83\overline{)4.098}$	$.096\overline{).4176}$
3.	$3.7\overline{)10.59}$	$.008\overline{).3753}$	$.047\overline{)25.665}$
4.	$2.8\overline{).1876}$	$.96\overline{)19.5}$	$24.2\overline{)19.602}$

Multiply. Express the products in nearest tenth.

	(a)	(b)	(c)	(d)	(e)
5.	230	.045	671	940	87.32
	.09	1.8	2.3	.035	5.4
6.	.764	135.8	5.067	1.489	7155
	7.09	3.72	480	760	5.46
7.	12.69	99.8	37.04	239	2.648
	381	.421	84.2	5.02	.059

Add:

8.	.18	4.63	139.7	8.205	$12.98
	.43	12.81	514.8	2.993	8.75
	.05	9.46	97.4	47.086	3.25
	.64	35.00	600.3	15.119	.89
	.97	8.74	53.9	9.703	1.46
	.56	30.99	342.0	36.340	35.00
	.22	57.38	195.6	72.318	42.95

Subtract:

9.	6.03	157.82	6.009	540.2	$115.85
	4.92	98.27	2.793	189.6	99.78
10.	.052	8.004	805.7	1.270	$600.00
	.019	3.928	369.8	.675	190.75

In Round Numbers

Jack read in his geography that the area of the state of North Carolina is 52,712 square miles. "Well," said Jack, "in round numbers the area is 52,700 square miles. That is the number rounded off to nearest hundred."

1. What is the area when the number is rounded off to nearest thousand?

• To say that the area is about 53,000 square miles is probably near enough to the true area for most uses. The number 52,712 rounded to the nearest thousand is 53,000, and rounded to the nearest ten thousand, it is 50,000.

2. What is the area of each state rounded to nearest thousand?

► When we round off a number, we consider only the figure immediately following the one we wish to retain. If that figure is 5 or more, we increase by 1 the last figure retained. If it is less than 5, we drop the figure and replace it with zero.

3. Round off these numbers to nearest thousand:

8631 986 15,005 476,903 7,108 89,995

4. Round off the above numbers to nearest hundred.

5. Rewrite these measures in nearest wholes:

17.3 ft. 4.95 bu. 58.08 mi. 8.8 ft. 1.005 in.

$$\begin{array}{r} 89 \\ \times 31 \\ \hline 89 \\ 267 \\ \hline 356 \end{array}$$

RIGHT!

$$\begin{array}{r} 89 \\ \times 31 \\ \hline 89 \\ 267 \\ \hline 2759 \end{array}$$

Estimating

1. Estimate, by rounding, the product of 29×49. 29 is almost 30, and 49 is almost 50. $30 \times 50 = 1500$. What is the exact product?

2. How do you estimate the product of 57×42? Is 60×40, or 2400, a good estimate?

3. To estimate the product of 35.8 and .47, we think of .47 as about $\frac{1}{2}$, and $\frac{1}{2}$ of $36 = 18$. Is 18 a good estimate? What is the exact product?

Estimate the product. Then find the exact product.

4. $26.7 \times .34$ (Is $27 \times \frac{1}{3}$ the approximate answer?)

	(*a*)	(*b*)	(*c*)
5.	$.24 \times 488$	$\frac{5}{16} \times 156$	$\frac{7}{12} \times 740$
6.	2.4×1.2	$56 \times .54$	3.9×44
7.	$54 \div 1.8$	$7.75 \div 2.5$	$7 \div .33$
8.	$5.9\overline{)24.01}$	$2.1\overline{)6.3}$	$.54\overline{)9}$
9.	$.95\overline{)3}$	$3.75\overline{)33.75}$	$5.2\overline{)25.52}$

10. When we multiply $6 \times .8$, how do we know the product will be less than 6?

11. When we multiply 8 by 1.8, how do we know the answer will be more than 8? Why will the product be less than 16?

12. When we divide 8 by 1.8, how do we know that the quotient will be a little more than 4?

Significant Figures

• One year the owners of mines in West Virginia reported that they had produced 168,589,280 tons of coal. Long trains of cars—sometimes 60, 80, or 100 cars in a train—hauled the coal away to towns and cities to heat homes and to turn the wheels of industry.

1. If each carload is 50 tons, how many tons does a hundred-car train haul?

2. How many such trainloads were needed to haul the coal that West Virginia produced?

3. In speaking of the coal that West Virginia produced, what figures are significant; that is, what figures carry meaning? whole tons? hundreds of tons? thousands of tons? millions of tons?

4. Jack read 168,589,280 as "169 million tons." Jack rounded the number to nearest ▨. Tom read 168,589,280 as "170 million." Tom rounded the number to nearest ▨.

5. In March Mr. Brown bought a small truckload of coal to last the rest of the winter. The price of the coal delivered was $20 a ton. At $20 a ton what is the cost per pound?

6. Mr. Brown inquired, "How much coal did you bring?" The coal dealer replied, "Just a small load, 3786 pounds. Shall we call it 2 tons?"

"No," said Mr. Brown, "we'll call it 3786 pounds. The difference in what I would pay is too much."

a How much would Mr. Brown pay if the amount were rounded to 2 tons?

b How much would he pay if they figured the exact amount? How much would the difference in cost be?

7. To Mr. Brown what was the smallest significant weight of coal? whole ton? nearest thousand pounds? nearest hundred pounds? nearest pound?

Rounding Large Numbers

Often approximate answers are as useful as exact answers. In such case we use the significant figures.

The table gives the number of farms and the amount of farm land in 10 states.

Rounded to nearest thousand, Alabama has 177,000 farms, and rounded to nearest million, Alabama has 21,000,000 acres of farm land.

Colorado has 41,000 farms and 38,000,000 acres of farm land.

States	Farms (number)	Farms (acres)
Alabama	176,956	20,810,492
Colorado	40,749	38,385,234
Iowa	192,933	34,044,533
Kansas	120,167	50,023,538
Maryland	32,500	3,896,608
Minnesota	165,225	32,284,539
New York	105,714	15,070,832
Ohio	177,074	19,991,586
Texas	292,947	145,812,733
W. Virginia	68,583	7,351,874

1. Round the number of farms to the nearest thousand. How many farms does each state have?

2. Round the number of acres of farm land to nearest million. How many acres of farm land does each state have?

3. Which three states have about the same number of farms? Which two of these states have about the same number of acres in farms?

4. Compare Kansas and New York in respect to number of farms and number of acres of farm land.

5. What is the average size of farms in Alabama?

To answer the question, we use rounded or significant figures. We divide thousands of acres (21,000) by thousands (177) of farms. Why is 119 acres a sensible answer?

```
      118.6
177)21,000.0
   17 7
   ----
    3 30
    1 77
    ----
    1 530
    1 416
    -----
      114 0
      106 2
      -----
```

Answer: 119 acres

6. What is the average size of the farms in nearest whole acres in each of the other states?

Problems

1. A sample of mineral weighing 35.8 ounces contained 2.4 ounces of impurities. How many ounces of pure mineral did the sample contain?

2. Jack Collins belongs to the 4-H Club. He raised 6175 bushels of potatoes on a piece of land containing 72.75 acres. What was the yield per acre in nearest hundredth of a bushel?

3. At the Alton Dairy Farm cows are fed hay according to their weight. The allowance is 2.25 pounds of hay per day for every 100 pounds the cow weighs. How much hay per day in nearest pound should be fed to a cow weighing 875 pounds?

4. John Bradley ran the 220-yard dash in 20.8 seconds. How many yards did he average per second?

5. Mary King's allowance is $5.00 a week. She plans to spend .45 of her allowance for clothes. How much of her weekly allowance will be spent for clothes? How much can she spend for clothes in a year?

6. Mr. Smith and Jack traveled 117.8 miles the first day of their automobile trip. The second day they went 138.6 miles. Their destination was 350 miles from their home. How far did they have to go on the third day?

7. Mr. Molby bought a home for $19,900. He agreed to pay $7500 in cash and the balance at $75 a month. How many months will it take him to pay for his home?

8. One year the rainfall in Cedar Falls for the 4 weeks in June measured 6.3 inches, 4.2 inches, 1.8 inches, and .7 inches. How many inches of rain fell in Cedar Falls that June? What was the average rainfall in nearest tenth per week? per day?

9. Compare the atomic weight of iron which is 55.85 with that of tin which is 118.70.

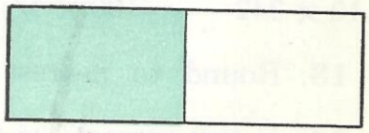
Decimals and Common Fractions

Northfield hoped to raise $20,000 for the Community Chest. A large thermometer was placed in front of the courthouse to show how much money was contributed each day.

A decimal may express the relation between two quantities. So we can say that .25 of the goal was raised.

1. What part of the rectangle is shaded? Instead of saying that $\frac{1}{2}$ of the rectangle is shaded, we can say that .5 or .50 of the rectangle is shaded.

$\frac{1}{2}$ and .5 and .50 are equivalent fractions, and we may substitute one for the other in figuring.



We divide the numerator of a fraction by its denominator to find the decimal equivalent:

$$\frac{1}{2} = 2\overline{)1.0} \quad .5 \text{ in tenths}$$

$$\underline{1\,0}$$

.50 in hundredths

.500 in thousandths

2. Change these common fractions to decimals, each in nearest hundredth:

$\frac{3}{8}$ $\frac{5}{7}$ $\frac{9}{16}$ $\frac{1}{3}$ $\frac{5}{6}$ $\frac{3}{4}$ $\frac{7}{8}$ $\frac{2}{3}$

3. Rewrite these quantities so that the decimal part of each will be in nearest hundredth:

$2\frac{1}{4}$ $3\frac{1}{3}$ $5\frac{2}{3}$ $8\frac{3}{4}$ $1\frac{2}{3}$ $6\frac{1}{8}$ $4\frac{5}{8}$ $1\frac{7}{8}$

Keeping in Practice

	(a)	(b)	(c)	(d)
1.	$8635 + 1202 + 6390 + 426 + 690$	$15030 - 9628$		
2.	$\$18.25 + \$340.60 + \$90.18 + \$6.50$	$\$50 - \$16.95$		
3.	Find the average: 22, 10, 13.	6 is $\frac{1}{4}$ of ▨		
4.	$4.2 + 8.6 + 25.4 + 17.9 + 6.0$	$\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$		
5.	86×973	$945 \div 7$	$9\frac{7}{10} - 3\frac{4}{5}$	$9 \div 4.5$
6.	$\frac{3}{4} \div \frac{1}{12}$	$.96 - .58$	$\frac{1}{2} \times 18$	73×208
7.	$.06 \times 3.2$	$\frac{3}{4} \times \frac{5}{9}$	$.04 \times 63$	$84302 \div 37$
8.	$350 \div .07$	$4\frac{1}{2} \times 1\frac{2}{3}$	$8.643 \div 100$	$\frac{1}{2} \times \frac{1}{3}$
9.	$8 \times 1\frac{1}{7}$	$8\frac{3}{4} \div \frac{1}{2}$	$3\frac{5}{8} + 2\frac{5}{6}$	$4\frac{1}{2} \div 1\frac{3}{8}$

10. $\frac{1}{5} =$ ▨ (dec. fraction)

11. How many degrees of fever did the victim have?

109.6° Fever Victim Alive

12. Write the products without multiplying: 100×86 10×342 100×57.3 10×8.6 1000×15.25

13. Round to nearest hundred: 843; 1290; 2610; 992.

14. Is this correct? $25 \times 36 = 9 \times 100$

15. How long will it take a car going 60 miles an hour to go 130 miles?

16. If the dividend and the divisor are multiplied by the same number, how will the quotient be affected?

17. When we multiply a decimal by a decimal, how do we find the number of places to point off in the answer?

18. When both terms of a fraction are divided by the same number, will the value of the fraction be larger, smaller, or the same?

Short Cuts

• Multiplying by a decimal fraction is sometimes easier if we change the decimal to a common fraction and multiply by the common fraction.

Find the answers. Which way is easier?

	(*a*)	(*b*)
1.	.75 × 268 or $\frac{3}{4}$ × 268	$\frac{1}{3}$ × 960 or .333 × 960
2.	.375 × 720 or $\frac{3}{8}$ × 720	$\frac{1}{8}$ × 160 or .125 × 160
3.	.667 × 180 or $\frac{2}{3}$ × 180	$\frac{1}{6}$ × 120 or .167 × 120

• If we understand the number system and number relations, we may sometimes shorten or even simplify our work in arithmetic.

4. Let us multiply 48 by 5. We think of 5 as $\frac{1}{2}$ of 10. We multiply 48 by 10 and get 480. Now $\frac{1}{2}$ of 480 is 240.
So 5 × 48 = ▨.

5. Without using your pencil read, from left to right, the product of 5 times $364.80.

6. Let us multiply 48 by 25.

① We think of 25 as $\frac{1}{4}$ of 100. We multiply 48 by 100. 100 × 48 = 4800. Then we divide 4800 by 4. 4800 ÷ 4 = 1200.
② Or we may divide 48 by 4 and then multiply by 100.
48 ÷ 4 = 12, and 100 × 12 = 1200.

```
 48
 25
240
96
1200
```

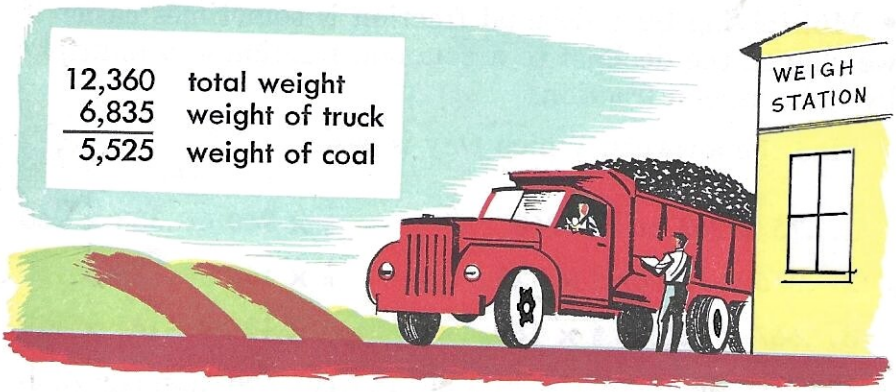
7. Let us multiply 84 by 25. We multiply 84 by 100. 100 × 84 = 8400. Then we divide 8400 by 4. 8400 ÷ 4 = 2100.

►To multiply by 25, multiply by 100 and divide by 4.
►To multiply by 50, multiply by 100 and divide by 2.
►To multiply by $12\frac{1}{2}$, multiply by 100 and divide by 8.

8. What "short cuts" could you use?

a Multiply by 50 **c** Multiply by 20 **e** Multiply by $33\frac{1}{3}$
b Multiply by $12\frac{1}{2}$ **d** Multiply by 75 **f** Multiply by $16\frac{2}{3}$

Coal by the Ton



1. The Smithton Coal Company delivered a truckload of coal to Mr. West. The truck weighed 6835 pounds, and the total weight of the truck and coal was 12,360 pounds. How much coal did Mr. West get in nearest tenth ton?

To divide by 2000, (1) we can divide both divisor and dividend by 1000, and (2) we then divide 5.525 by 2. We divide until we get our quotient in hundredths. Then we write our answer in nearest tenth.

$$2000\overline{)5525.0000} = 2.7625$$

$$2\overline{)5.525} = 2.76$$

Answer: 2.8 tons

2. Find the weight of each load in nearest tenth ton:

Truck	Customer	Total Weight	Weight of Truck	Weight of Coal	Tons of Coal
1	J. Smith	13397	6835	____	____
2	D. Fall	12940	5890	____	____
3	N. Bell	12785	6345	____	____
1	E. West	11970	6835	____	____
2	S. Ray	13643	5890	____	____
3	B. Reed	12075	6345	____	____

The Smithton Coal Company charges $18.25 a ton for the coal it delivers to customers.

3. How much did Mr. Smith pay for his coal?

4. Find the cost of Mr. Fall's coal; of Mr. West's coal.

Practice with Common Fractions

	(a)	(b)	(c)	(d)
1.	$8 \div \frac{1}{2}$	$\frac{2}{3} \div 2$	$\frac{3}{8} \div \frac{5}{16}$	$4\frac{1}{2} \div \frac{3}{4}$
2.	$4\frac{1}{2} \div 1\frac{1}{2}$	$6\frac{1}{4} \div 1\frac{1}{4}$	$1\frac{1}{3} \div \frac{3}{16}$	$7\frac{1}{2} \div 10$
3.	$18\frac{1}{2} \div 4\frac{1}{2}$	$16 \div 2\frac{4}{5}$	$5 \div \frac{2}{3}$	$\frac{9}{10} \div 5$
4.	$\frac{5}{9} \div \frac{1}{5}$	$11\frac{1}{2} \div \frac{1}{8}$	$16 \div 2\frac{2}{3}$	$4\frac{4}{5} \div \frac{3}{5}$
5.	$12 \div 2\frac{2}{3}$	$7\frac{1}{2} \div 2\frac{1}{3}$	$\frac{3}{4} \div \frac{2}{5}$	$10 \div \frac{3}{5}$
6.	$3\frac{1}{2} \div 1\frac{1}{2}$	$16 \div \frac{3}{4}$	$\frac{7}{8} \div \frac{5}{16}$	$3\frac{3}{16} \div \frac{2}{5}$
7.	$25\frac{1}{2} \div 3$	$4\frac{4}{5} \div 5\frac{2}{3}$	$18 \div \frac{2}{9}$	$\frac{9}{16} \div \frac{3}{4}$
8.	$6 \times \frac{2}{3}$	$\frac{9}{10} \times \frac{2}{5}$	$4\frac{1}{2} \times \frac{3}{8}$	$2\frac{5}{16} \times 1\frac{1}{8}$
9.	$\frac{7}{12} \times \frac{2}{5}$	$3\frac{4}{5} \times 6$	$10 \times 1\frac{1}{4}$	$\frac{7}{16} \times \frac{4}{5}$
10.	$\frac{3}{4} \times 2$	$20 \times 1\frac{3}{5}$	$5 \times \frac{1}{8}$	$6\frac{1}{4} \times 4\frac{1}{4}$
11.	$8 \times 2\frac{5}{6}$	$\frac{4}{5} \times 350$	$\frac{9}{16} \times 7\frac{1}{3}$	$\frac{1}{3} \times 5$
12.	$3\frac{7}{8} \times 6$	$2\frac{1}{3} \times \frac{1}{3}$	$\frac{5}{6} \times \frac{2}{3}$	$1\frac{1}{2} \times \frac{7}{12}$

Subtract:

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
13.	$18\frac{1}{2}$	9	$26\frac{3}{8}$	$9\frac{3}{4}$	$\frac{1}{3}$	$12\frac{5}{12}$	$6\frac{1}{2}$
	$5\frac{2}{3}$	$\frac{4}{5}$	$18\frac{3}{16}$	8	$\frac{1}{4}$	$8\frac{2}{3}$	$5\frac{7}{8}$
14.	27	8	$5\frac{4}{5}$	$14\frac{1}{2}$	20	$10\frac{3}{4}$	$8\frac{1}{3}$
	$2\frac{2}{3}$	$\frac{5}{16}$	$3\frac{1}{2}$	$10\frac{5}{8}$	$11\frac{2}{5}$	$8\frac{1}{6}$	$6\frac{5}{12}$

Add:

15.	$\frac{1}{2}$	$13\frac{5}{6}$	$14\frac{2}{5}$	$8\frac{5}{8}$	$11\frac{3}{16}$	$3\frac{3}{4}$	$10\frac{1}{2}$
	$\frac{2}{3}$	$4\frac{2}{3}$	$3\frac{1}{2}$	$9\frac{3}{4}$	$20\frac{1}{4}$	$6\frac{3}{5}$	$8\frac{3}{4}$
	$\frac{3}{4}$	$10\frac{1}{2}$	4	$12\frac{1}{2}$	$9\frac{7}{8}$	$9\frac{3}{4}$	$6\frac{5}{8}$

16. Mr. Potter had $5\frac{1}{8}$ yards of printed cotton left on a bolt. After Mae bought $3\frac{3}{4}$ yards of it, he put the remaining piece on the remnant table. How many yards of cotton were in the remnant?

Do You Know?

Progress Test

1. $746.09 + 868.49 + 23.75 + 340.06 + .12 + 20.87$

2. $8.560 + 9.007 + .635 + 1.905 + .700 + .008 + 3.695$

	(a)	(b)	(c)
3.	$85.732 - 13.003$	$340.0 - 137.9$	$60.05 - 28.30$
4.	$5.04 \times .622$	24.5×809.47	$.076 \times 1.9$
5.	$258 \div .29$	$34.692 \div 4.9$	$235.6 \div .062$

6. Round off these numbers to nearest hundredth:

4.782 14.036 .705 89.798 1.164 3.997

7. Rewrite the above numbers in nearest whole.

8. Find the products mentally:

10×5.6 $100 \times .203$ 1000×155.04 100×6.72

9. Find the quotients mentally:

$616 \div 10$ $23.5 \div 100$ $6.53 \div 1000$ $8 \div 100$

10. By what should you multiply each of these numbers to make it a whole number?

64.3 .56 1.004 8.68 .073 9.5

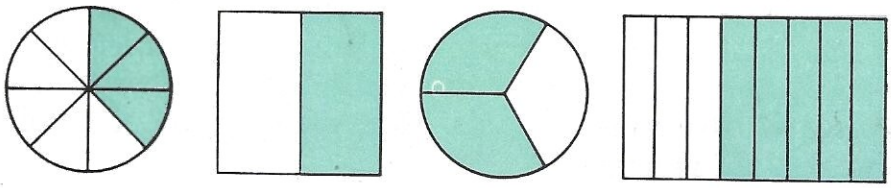
11. Change the fractions in these numbers to decimals expressed in nearest hundredths:

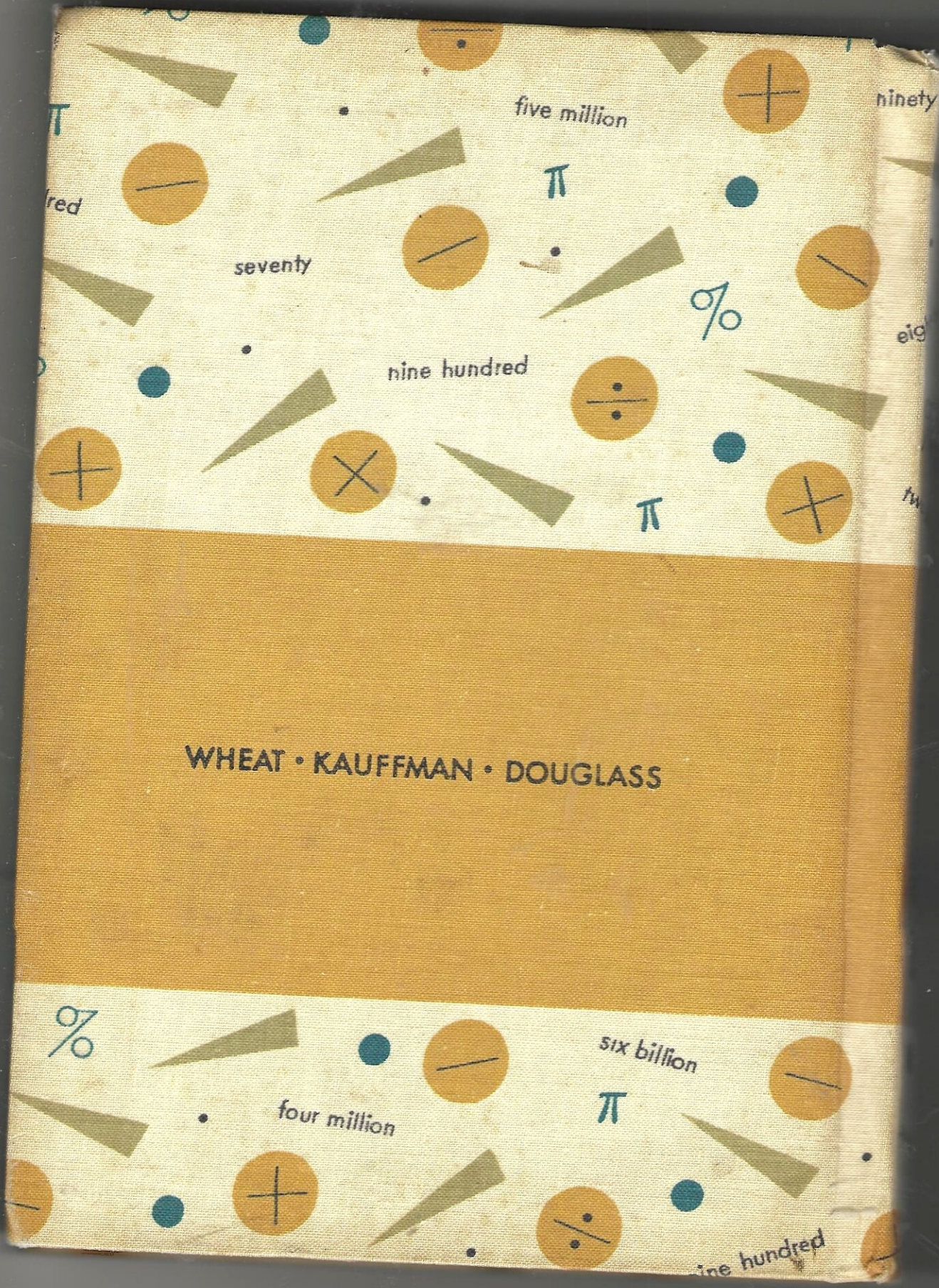
$\frac{3}{4}$ $\frac{4}{5}$ $2\frac{3}{8}$ $5\frac{9}{20}$ $7\frac{2}{25}$ $12\frac{1}{8}$ $3\frac{2}{3}$

12. Mr. West drove his car 350 miles. He bought 22 gallons of gasoline. Find the average mileage per gallon. Which answer, 15.909 miles per gallon or about 16 miles per gallon, is more sensible?

$$\begin{array}{r} 16 \\ 22\overline{)350} \\ 22 \\ \hline ?\,\overline{)130} \\ \underline{132} \end{array}$$

13. What fractional part and what decimal part of each figure is colored? white?





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